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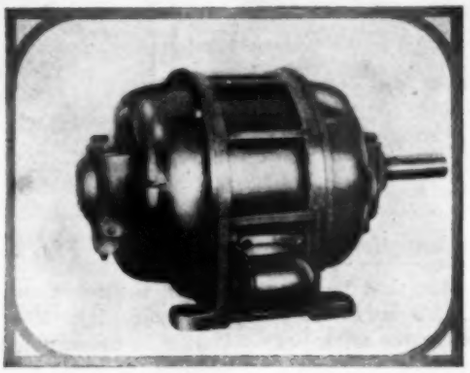


Applying Electrical Equipment to Production Machinery

By Robert Corey Deale
Electrical Engineer, Niles-Bement-Pond Co.

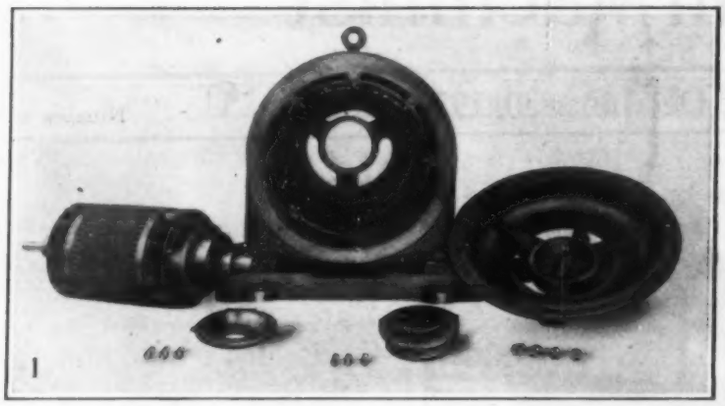
THE intelligent application of electrical equipment to production machinery is impossible without a broad general knowledge of the type of equipment available and the peculiar advantages and disadvantages of each type. In addition, the mechanical operation of the machine and the physical demands of its operation should be clearly understood. Too many applications have been made without proper correlation of the requirements of the machine with the possibilities of the electrical equipment. Usually the designer of the machine has but a limited electrical knowledge, while the electrical engineer or the salesman who has been requested to recommend equipment, all too often has no clear idea of the machine. To insure the best possible results, co-operation between the designer and electrical engineer should start with the first rough layouts in the drafting room.

Hence, the attempt has been made in these articles to give the mechanical engineer and designer a general knowledge of the possibilities and limitations of the standard types of motors and controllers as applied to production machinery, together with descriptions and illustrations of equipments that have been used and found to be satisfactory.

ELECTRIC MOTORS, in general, may be divided into alternating-current motors and direct-current motors. This distinction is quite fundamental. Direct-current motors resemble other direct-current motors, regardless of voltage or winding, while alternating-current motors have a family resemblance, and in but few cases would a d.c. motor be mistaken for an a.c. motor, and vice versa. This distinction applies to the electrical and mechanical characteristics of the motors themselves, and usually to the way they act when applied to a machine.

The characteristics of squirrel-cage and slip-ring induction motors are discussed in this article, the first of a series by Mr. Deale. In additional articles, other motors will be studied, then manual and automatic controllers, and the application of this equipment to production machinery

The usual forms of a.c. motors are the squirrel-cage induction, slip-ring or wound-rotor induction, synchronous, synchronous-induction, repulsion, repulsion-induction, series, and special adjustable-speed motors. These all have an inherently constant speed except the slip-ring induction motor and some of the adjustable-speed motors. The most useful, and hence the most common, a.c. motor is the squirrel-cage induction motor, which is standard with the majority of electrical manufacturers for 110, 220, 440, 550 and 2,200 volts, two or three phase, 25, 40, 50 and 60 cycles. It is a very simple, rugged motor, which, in its usual form, has an average full-load starting torque of 135 per cent, and so cannot be readily used for services requiring high starting torque or frequent starting and reversing. Such a motor is shown in the headpiece. It will be noted that this motor has a connection box so that a conduit system may be run up to the motor without there being any necessity for exposed wiring.



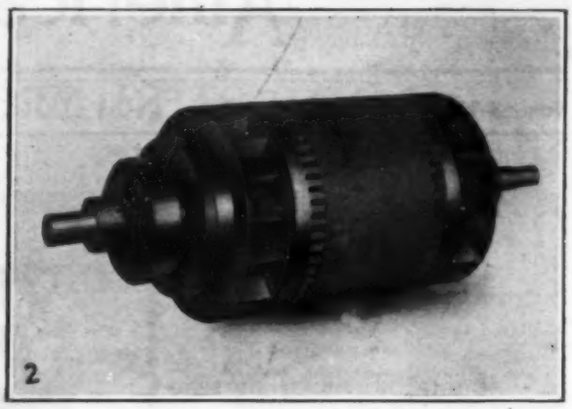


Fig. 1—Squirrel-cage induction motor, disassembled. Fig. 2—Squirrel-cage rotor

In Fig. 1 may be seen a similar motor that has been partially disassembled. A motor of this sort consists of a wire-wound stator, a rotor, and a frame with bearings in which the shaft carrying the rotor revolves.

The stator consists of a ring of iron built up from thin punchings and supported in an iron or steel frame called the yoke or housing. The ring of punchings has a number of slots in its inner surface, through which the coils of the stator are wound.

The rotor consists of punchings in the form of rings or disks, which are either mounted directly on the shaft or on an intermediate spider. These punchings have slots in the outer surface through which are forced conducting bars, usually of copper or brass. No insulation is necessary between the bars and the iron. The ends of these bars are connected by brazing, casting, or welding to two rings, one at either end, which may be plainly seen in Fig. 2. This assembly makes up the so-called squirrel-cage winding. In one make of motor, the bars and end rings are formed by punching and rolling from a single piece of sheet metal. Fans are usually put at either end of the rotor to blow air through the motor and so keep it cool. As the gap between the rotor and stator is only a few thousandths of an inch after the motor is assembled, care must be taken to assemble the motor properly in the first place, and then make certain that the bearings do not wear and dangerously decrease this air gap.

There is no electrical connection between the stator and rotor, the action in the motor being between the current in the coils of the stator winding and the currents inducted in the rotor by transformer action by the stator current.

The motor shown in Fig. 1 has a cast-iron frame, but one motor manufacturer builds up all such parts from structural steel by arc welding without the use of cast-iron or cast-steel parts.

The standard motor of this squirrel-cage type drops about 5 per cent in speed between no load and full load. This drop in speed, or regulation as it is called, is of negligible amount for all ordinary purposes. Such a motor is used for lathes with all-geared heads; for planers in which the table is reversed by shifting belts or clutches; for milling machines and drilling machines with speed-box drives; and for a large number of similar applications.

A modification of this motor is built with a higher resistance squirrel cage, which gives a higher starting torque than the general-purpose motor. This is called a high-resistance, or high-torque squirrel-cage motor, and is used wherever high starting torque is required, but where good running performance is not a requisite. High-torque squirrel-cage induction motors may be thrown directly on the line, either by a drum controller or other manual switch, or by an automatic across-the-line starter.

This high-torque motor has a drop in speed between no load and full load of 10 to 40 per cent, and consequently is of no value for any application where constant speed is desirable, such as the main drive of most machine tools. However, it is very useful for traversing various machine elements such as the carriage of a lathe or the rail on heads of a planer; or for operating elevators. It is also valuable for machines in which a large amount of power is required for a small portion of the time, such as on punching and shearing machinery, and where a flywheel is used to obtain a better load factor. On this type of machine, the high-speed parts are purposely made with a large amount of inertia, requiring an appreciable time to be brought up to speed. When the machine is operated, the load is greatly increased, the speed falls, and the kinetic energy stored in the machine, most of which is in the flywheel, helps the tool make the cut. After the opera-

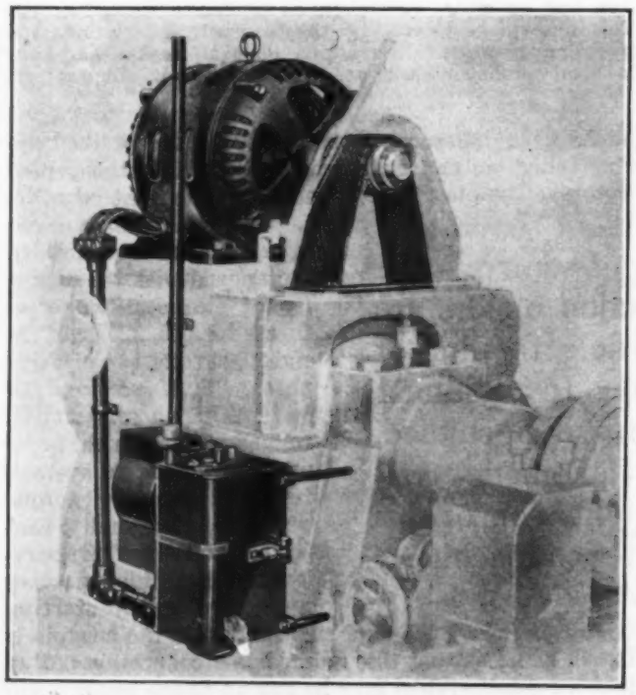


Fig. 3—Four-speed a.c. motor and controller on engine lathe

tion is completed, the motor accelerates the flywheel to full speed again. In this way a smaller motor may be used at better load and power factors than if a low-slip motor were used. In fact, a low-slip motor must have sufficient power to carry the machine over its peak load with little or no assistance from the flywheel, which is consequently of little value.

Yet another variation of the squirrel-cage motor is available, although it is believed that full use has not been yet made of its possibilities. This is the multi-speed type, which may have two or more speeds, obtained by different windings or combinations of the same winding. As usually built, these motors may have a single winding, which can be re-connected by means of a suitable switch to give two speeds, of which the higher is double the lower; or two windings with four speeds, of which the higher two are respectively double the lower two. These motors are built with any desired combinations of possible synchronous speeds, although more than four speeds are unusual. For 60-cycle motors, the usual speeds are 600, 900, 1,200, and 1,800 r.p.m. It is believed that this type of motor could be used on most machine tools where alternating current drive is required. The machine could be built with a small number of gear changes, and driven by a three-to-one adjustable-speed d.c. motor or this four-speed type of a.c. motor. It is believed that this would give a cheaper machine in that it would eliminate a number of gears, shafts, and clutches and at the same time it would make it possible to build a single type of machine for either direct or alternating current. In Fig. 3 may be seen an installation of this sort on an engine lathe, with a four-speed driving motor, and a drum controller, mounted on the head of the lathe, to start and stop the motor, and to change speeds.

The slip-ring induction motor is used where a relatively large starting torque is required, combined with reasonably good regulation between no load and full load. It is for use on three-phase circuits. The rotor of a slip-ring induction motor is wound with wire with the terminals of the winding brought out to these slip rings as shown in Fig. 4, instead of having a welded or cast "squirrel cage." For this reason it is sometime called a wound-rotor induction motor. In Fig. 5 is shown such a motor, complete with pulley, sliding base, and conduit boxes for both primary and secondary circuits.

To start a wound-rotor induction motor, resistance

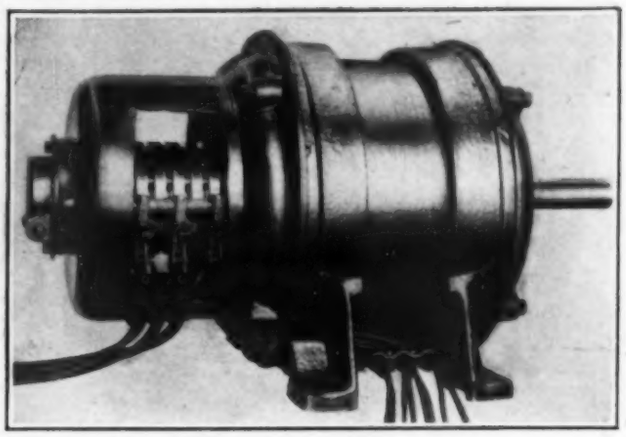
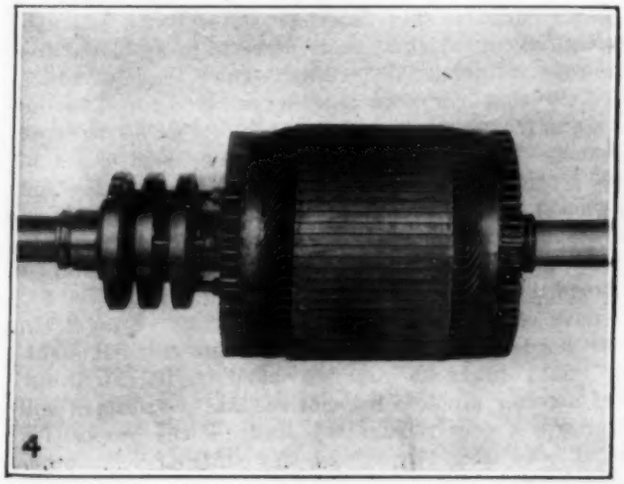


Fig. 6—Two-speed, slip-ring induction motor, showing large number of leads

is inserted in the three-phase secondary circuit by means of the three slip rings. The primary, or stator winding, is then connected to the line by a suitable switch, the rotor commences to turn over, and is brought up to speed by gradually short-circuiting the secondary resistor, until finally the slip rings are connected together. This type of control gives a high starting torque with a relatively low starting current.

Should a portion of the secondary resistor be left in circuit while the motor is under load, the speed would be reduced by an amount that depends both on the resistor and on the load. This method of speed variation is in general not satisfactory for machine tools, as the speed for any rheostat setting varies inversely as the load. However, it has its uses where conditions require a momentary decided drop in speed due to load, as in a wheel lathe, where a slow-down of this nature is desired while cutting hard spots in the wheel. It may also be used where the load on the machine is relatively constant.

A slip-ring or wound-rotor induction motor is also used for installations requiring frequent starting or reversal underload, as in the case of drilling machines or boring mills. When so used, the controller is arranged to short-circuit the secondary resistor during the running period. This controller may be manually or magnetically operated. In another design, no controller is used at all, but an equivalent effect is obtained by using inductance coils in parallel with the resistor.



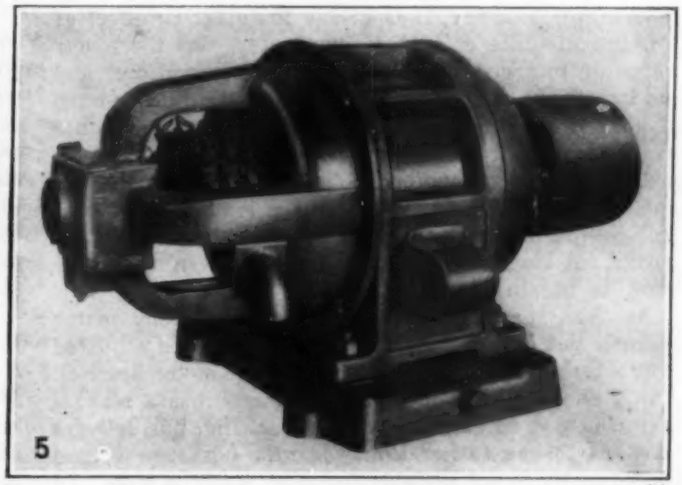


Fig. 4—Rotor of slip-ring induction motor. Fig. 5—Slip-ring induction motor

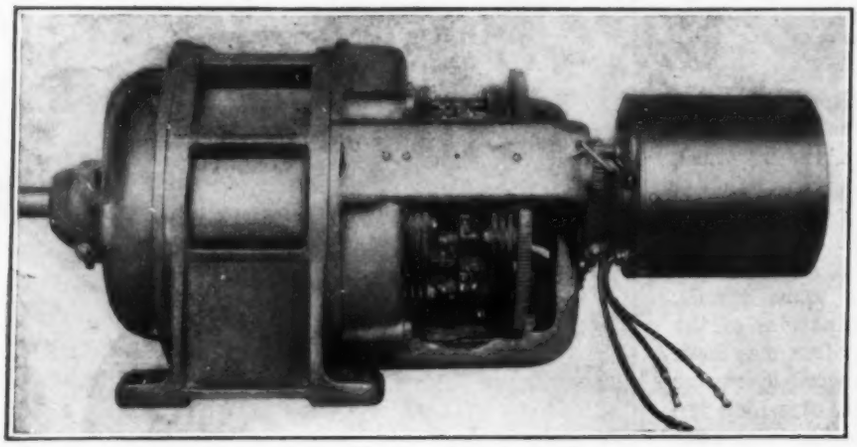


Fig. 7—Adjustable-speed, brush-shifting a.c. motor

Slip-ring induction motors may also be built to give two speeds. Four-speed motors are not practical because of the necessity of having separate rotor circuits as well as separate stator circuits for each speed. The higher speed is usually double the lower speed, although not necessarily so. Note in Fig. 6 the number of slip rings and leads of a two-speed motor of this type.

Motors are built with resistance in the rotor circuit that is short-circuited by a centrifugal switch, which operates automatically when the motor reaches a predetermined speed. This type of motor may be connected directly to the line at start by means of any ordinary across-the-line switch, either manual or magnetic. This is the so-called self-starting motor.

Another type of self-starting motor is just coming on the market, although the basic idea is nearly thirty years old. It has either two squirrel-cage windings that are independent of each other or one squirrel-cage winding of peculiar form. With this type of motor the starting current is limited, but a relatively high starting torque is obtained. Consequently this motor is suitable for applications in which acceleration and good running characteristics are important.

In the double squirrel-cage type, one of the windings has high resistance and low inductance, while the other has high inductance and low resistance. At start the current induced in the secondary of the motor has line frequency. The impedance of the low-resistance winding at this frequency is so high that a large proportion of the current flows in the high-resistance winding and a small part in the low-resistance (high inductance) winding, thus giving the starting effect of a high-resistance or high-torque motor. As the motor comes up to speed, the secondary frequency drops, and the impedance of the low-resistance winding drops until at normal running speeds, the high-resistance winding has little effect, and the motor acts much as a standard squirrel-cage motor. This class of motor is applicable to the many cases where simplicity of control equipment, high-torque starting, or both are required. A single squirrel-cage may be given a peculiar form to obtain somewhat similar results.

Another special type of alternating-current motor recently put on the market may have its speed adjusted over a three-to-one range by shifting the motor brushes. Fig. 7 shows such a motor. This motor has a reasonably constant speed for any brush setting, but delivers constant torque rather than constant horsepower, and consequently is not suitable for most machine tools. To start this motor, the brushes should be rotated until they are at the position for the lowest speed. The motor may then be connected directly to the line by any suitable across-the-line starter, after which it may be brought up to the desired speed by rotating the brushes. As can be seen, this motor is very large and consequently it is somewhat difficult to fit into the limited space available on most machinery. A motor of this type that develops the same horsepower at its lowest speed will cost twice as much as an adjustable-speed direct-current motor. This fact is a very serious objection, for it makes the use of this motor uneconomical in most cases. Where a constant torque is required, the cost is more in line, as this type of motor as now built has constant-torque characteristics.

How I Gave a Discount—Discussion

By B. L. Henry

Barnum was right, but did Chester H. Franklin in his article under the title given above, on page 669, Vol. 65 of the *American Machinist*, "Barnum" the right man?

We have today in the machinery business and other lines, the so-called financial adviser, or in plain English, the "nickel twister." This man's job is not to increase sales, but to squeeze out of the dollar, a discount, a finance charge, or interest, and his particular pet account of discounts, interest, and finance charges will always show a profit, regardless of the gross sales, since there are no charges against it of overhead or anything else.

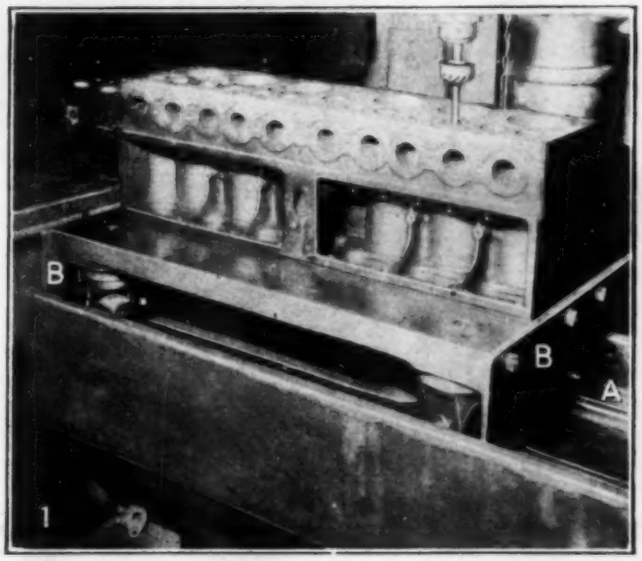
A small variation in the price will seldom have anything to do with the final closing of the sale, but regardless of price, the discount, in many cases, must be there. This discount goes to the "nickel twister's" pet account, and woe to the purchasing agent or buying superintendent who does not contribute to this account.

With this background can you blame the purchaser for asking for a discount? Maybe the buyer saw Mr. Franklin add in the necessary amount for the discount and inwardly thanked him for getting the discount he had to have to make his purchase pass final audit.

In my opinion, this financial adviser with his discounts, finance charges, and interest, is to blame for our orgie of installment selling. The "financial whiz" will show that a finance charge can be included in the price and then interest added on top of that on deferred payments. When the buyer is not wise he pays, net 30 days, a price which has included the finance charge and the nickel twister shows another "swell" profit. It is easy to understand why some firms prefer "term payments" to cash sales, with finance charge and interest included.

I have used the expression "installment selling." In those words there is subject matter for much thought. How many times do you find when buying anything, from a cotter pin to a locomotive, that a salesman will misinterpret your momentary study of the proposition and at once offer terms, cash discounts or some other inducements?

Automotive Production



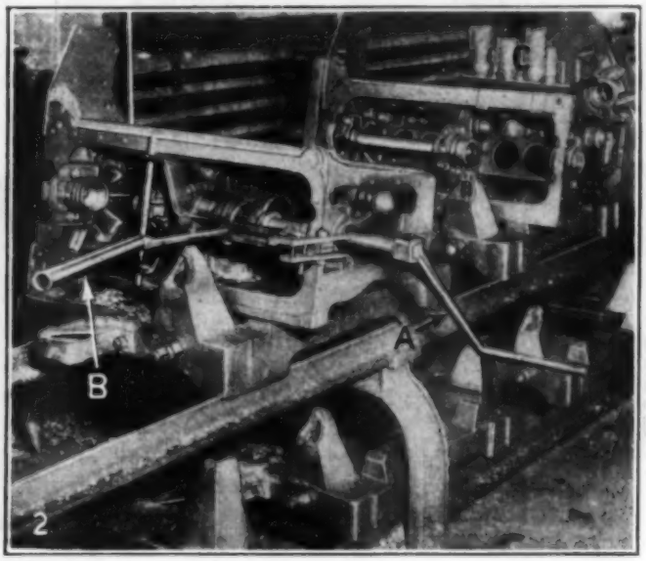


Fig. 1—Finishing the valve seats. Fig. 2—Facing center bearings

How Production Methods Vary in Shops Building "Light Sixes"

By Fred H. Colvin
Editor, *American Machinist*

Satisfaction in a finished product depends largely on the care with which it is assembled—Some of the Cleveland methods are shown in this article

THE importance of care in assembling a machine is appreciated by all good mechanics, since the best of workmanship can be rendered ineffective by putting the parts together in an improper or careless manner. A few examples of the care taken in assembling the Cleveland engines show that modern methods enable careful work to be done at low cost.

Before assembling the valves in the cylinder block, the seats are finished with the block on the table, or truck, shown in Fig. 1. The truck is mounted on four large casters having ball bearings both on the axles and at the tops, so that it can be easily moved to exact position under the spindle of the seating tool. The truck moves so easily that any slight eccentricity of the pilot on the seating tool will move it and so insure the seat being finished concentrically with the guide, and consequently with the valve stem.

The truck runs on a steel track *A* inside the cast-iron trough shown, the end plates *B* limiting the side movement. The cylinders shown are for the large engine, but the small cylinder block and crankcase combined are handled in the same way.

Leaving the truck shown in Fig. 1, the small block is turned on its side on one of the trucks in Fig. 2, the first operation being to face the ends of the center bearing. This is a hand operation, the facing bar being turned by the crank *A*, the lever *B* enabling the operator to force the cutters against either end of the bearing as desired. The bearings are then reamed to suit the crankshaft, with the reamers shown at *C*. They are kept on pegs in a board that has straps fitting over the edge of the crankcase. After the facing operation, the blocks are turned at right angles and set on an inclination, on the same trucks, and are ready for further assembly. Below the assembly track the empty trucks can be seen returning to the starting point.

The other end of the line is shown in Fig. 3, with the engine completely assembled and the oil pan in place. It will be noted that the engine is still in the same position. The angle adopted has proved very satis-

The fourteenth article. The concluding article will appear in an early issue.

Automotive Production

Some of the special appliances used in building the Cleveland "Light Six" motor

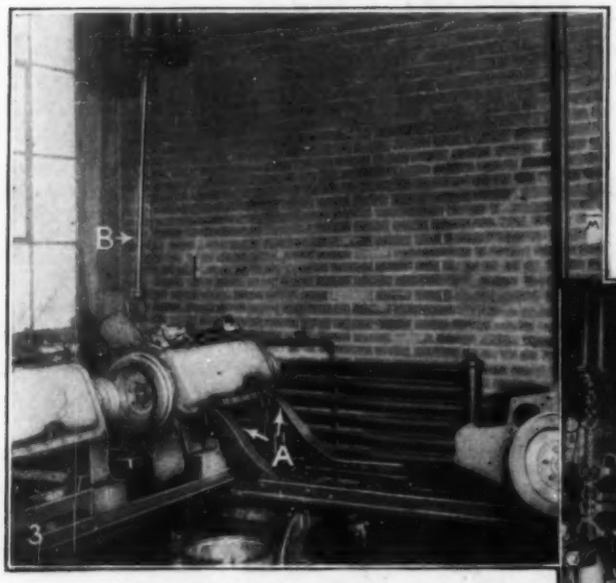


Fig. 3—Rolling the engine over

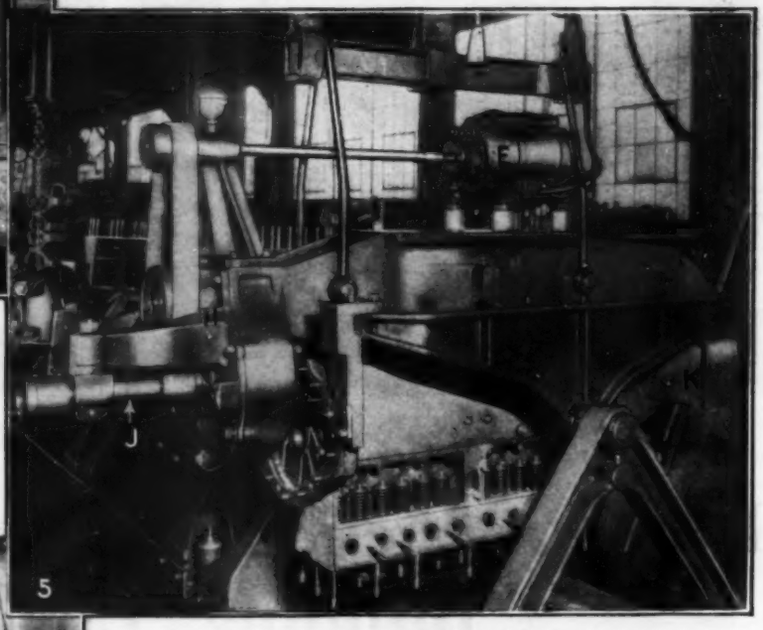


Fig. 5—The boring machine in place

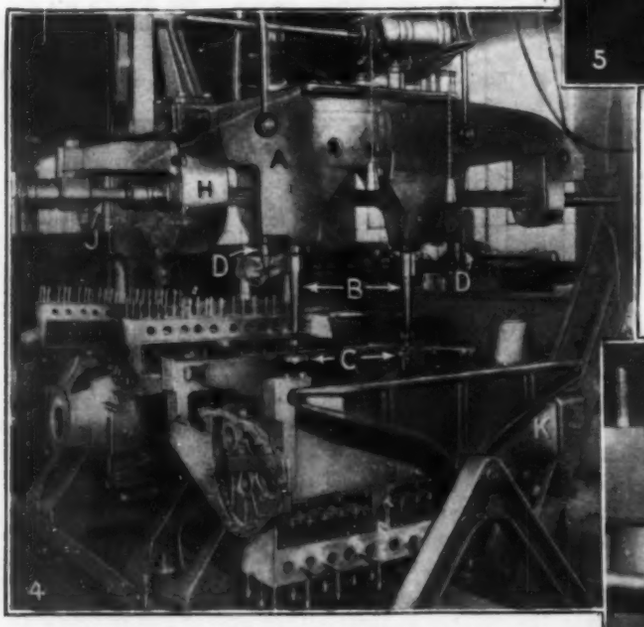
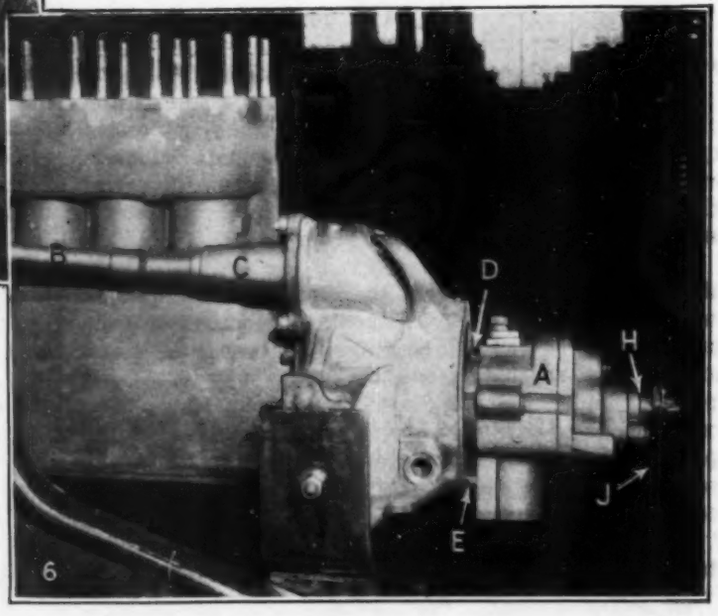


Fig. 4—Device for boring main bearings

Fig. 6—Boring and facing bell-housing



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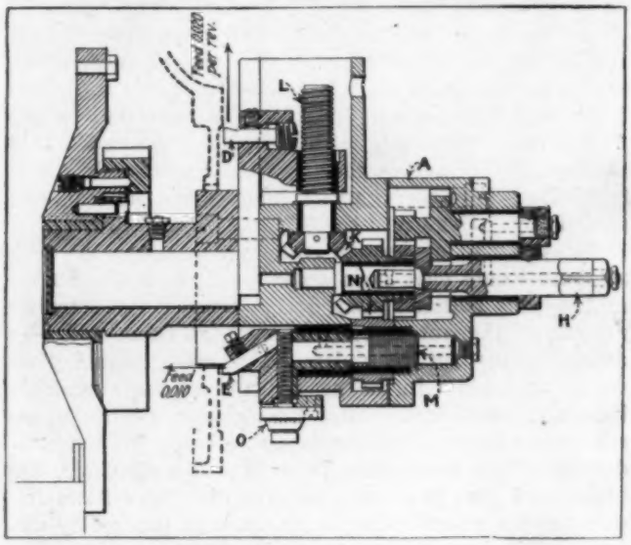


Fig. 7—Details of boring head for bell housing

factory, since it allows the pistons to be inserted, the rods to be put on the shaft, the head to be put in place, and all adjustments to be made without inconvenience to the operator or the necessity of rolling the engine.

At the end of the assembly track is a short track at right angles to it. This track has angles *A*, Fig. 3, that serve as "bumpers" or "roll-overs," to aid in getting the engine into an upright position. The air hoist *B* lifts the top of the engine so that the oil can pivots on the angles, and it is then an easy matter to roll the engine up and slide it down the inclined angles.

The main bearings for the large engines are bored with a special fly cutting machine, after the crankcase and cylinder block have been bolted together and placed in assembly trucks. The work is done with an unusual device especially designed by J. G. Moohl, tool supervisor, and is shown in Figs. 4 and 5. With the cylinder upside down in the stand, the boring device *A* is lowered in position as in Fig. 5. The tapered bolts *B*, go through two of the cylinders, rubber pads *C* on the ends act as guards and keep the bolts from striking the cylinder walls. Dowels *D* position the device.

The motor *E* drives the boring bar through the shaft, belt, and reduction gearing in the case *H*. The feed is by a fine-thread screw at *J*. The bar is shown in place in Fig. 5. Like letters refer to like parts in both views. This view also shows the lifting yoke and a boring bar in the inclined box where the latter is kept. The counterweight *K* helps to balance the weight of the driving mechanism when the boring device is being lowered into place. This method has proved very satisfactory and secures bearings and bearing alignment that give the desired results. The construction details are shown in Fig. 8. The three bearings are at *L*.

After the bearings have been line reamed and the crankshaft has been fitted in place, the flywheel housing is faced and bored as shown in Fig. 6, so as to be true and square with the crankshaft. To assure the alignment, the boring and facing head is attached to the flywheel and is revolved by driving the flywheel through its starter gear by the shaft *B*. The bracket *C* carries the pinion, and is bolted to the same surface upon which the electric starter is to be mounted. The boring is done with the tool at *D*. The tool *E* faces the end. Both tools are fed through the shaft *H* by the wrench *J*. Details of the construction of the head are shown in Fig. 7, like letters referring to like parts in both views. The facing tool *E* can be adjusted and locked as shown. The feed is through the bevel gears at *K* which turn the screw *L* for the facing feed and also turn the screw *M* for the boring feed through a pair of spur gears at *N*. The boring tool has micrometer adjustment at *O*.

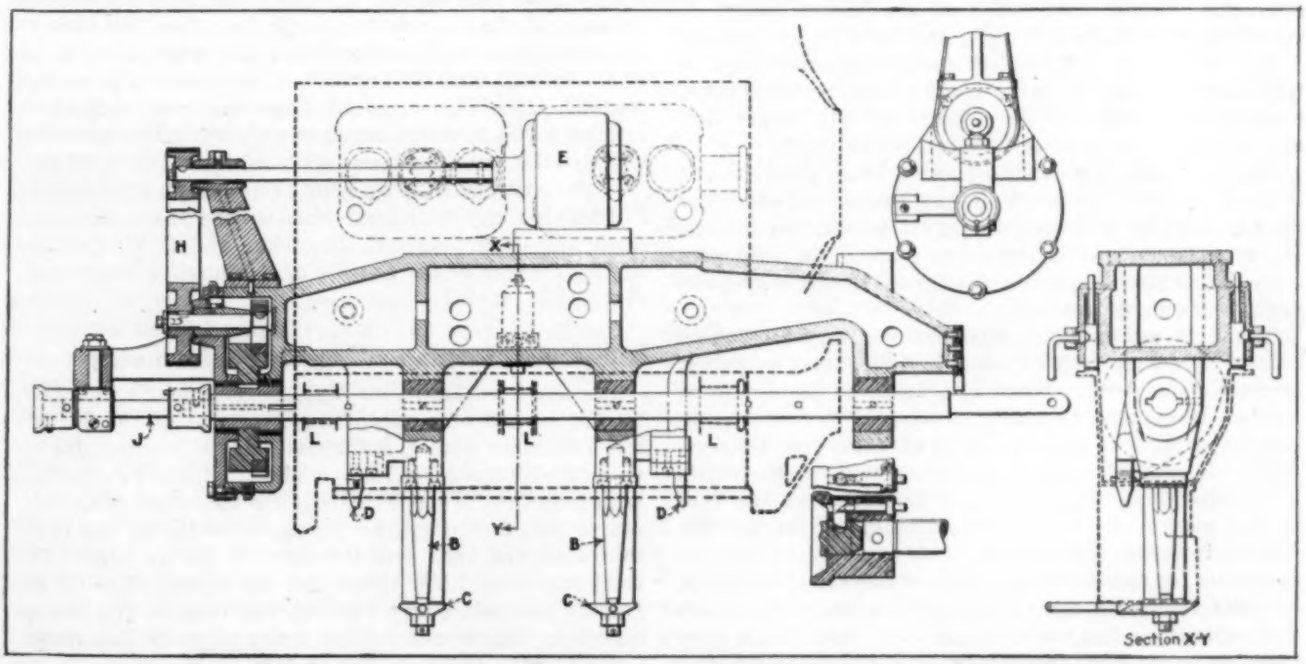


Fig. 8—Details of final line boring fixtures

Automotive Production

Abstracts

from other publications

Trend in 1927 Automobile Design

Among the changes so far noted for 1927 automobiles are increasing piston speeds; higher compression; heavier crankshafts with more supporting bearings; crankshafts machined all over, with counterweights or vibration dampers; lighter pistons; flexible engine mountings; air cleaners and oil filters; fuel strainers; ventilated crankcases; means to prevent clogging of crankcase oil pump screens; double contact interrupter in ignition systems; combined water pump and fan; flexible connection between engine and transmission to eliminate gear chatter; full depth gear teeth instead of stub for transmission, to reduce noise; increased reduction in steering gears and steering linkage friction for balloon tires; non-metallic shackles and wider rear treads on some of the larger cars. Frames are being stiffened to reduce stresses in closed bodies, particularly in the doors. Tubular cross members are being used to prevent weave in the frame.—P. M. Heldt, in *Automotive Industries*, Nov. 4, 1926, p. 759.

The Key to Prosperity

The present prosperity of the United States is due chiefly to the automobile. Without it there would not have taken place such increases in volume of money, consumers' income, and in profits.

In 1925 we spent more than $6,000,000,000 for motor cars and motor supplies. It must be admitted that money spent for motor cars is not spent for anything else, but the money spent by consumers is the force that drives all industry, and we have to ask whether consumers would have had that six billion dollars to spend on other things if there had been no automobile.

The answer is that the automobile industry pays in wages not far from $6,000,000,000 a year, which is large enough to account for the notable gain in wages that our workers have achieved in the last 15 years.

Business cannot go ahead making more goods unless it is able to sell the goods it has made, and consumer demand does not grow any faster than consumer income. In fact, the failure of consumer demand to keep pace with the output of goods is the chief reason why prosperity ends in depression.

The first reason why consumer buying lags behind output is because industry does not disburse, as wages, as much money as it expects consumers to pay for those goods. Under the necessity of saving, moreover, consumers do not spend even as much money as they receive. If industry paid to consumers all of the money it received from consumers, and if consumers spent all of that money, there would be no booms or depressions.

Nobody knows exactly how much money goes into pay envelopes because of the building of factories, machines, oil wells, refineries, mines, cars, and highways, for which the automobile has been responsible. Everybody does know, however, that the amount is huge. Without such automotive manufacturing development other industries would not have gone as far as they have gone.

The automobile builders have created an industry that gives employment to 3,000,000 workers, and yields $700,000,000 in taxes. They have enabled the workers to buy with their wages fully 20 per cent more than they could buy before there was an automobile industry. They have also had an influence in sending congested populations into the suburbs.

But the rate of growth cannot long continue. Just as there would have been a deficit of consumer buying in the past had not that deficit been avoided by the growth of the automobile industry, so there will be a deficit in the future, unless some other industry develops as rapidly in the near future as the automobile industry. Business cannot keep on prospering unless consumers keep on getting enough money, but if we can develop other businesses in sufficient magnitude, and make sure that the right amount of money flows into use, there appears to be no reason why prosperity cannot continue for generations.—W. T. Foster and Waddill Catchings, in *World's Work*, December, 1926.

Worm Gears for Automobiles

The worm gear drive is an English development and came to the United States about the time of the transition from straight bevel to the spiral bevel gear. One of the objections was the reduced road clearance with the worm underneath and the body height with the worm above the wheel.

The cost of the worm drive is usually considered higher than the spiral bevel although English builders who use both contend that, on the basis of a complete assembly, there is practically no difference in the cost. The worm gear has a very long life, there being instances of over 200,000 miles with complete satisfaction.

Both duralumin and aluminum bronze has been used for the gear with success, though some favor a phosphor bronze. Worms should be fairly free from heat-treatment warpage, have a tough core and scleroscope to 75 or 85. S.A.E. steel 2315 with heat treatment G is recommended, especially for small diameter worms. A backlash of 0.005 to 0.010 in. is customary. The pressure angle of the teeth has been increased from 14½ to 30 deg.

A properly made worm gear drive has an efficiency of 97 to 99 per cent with hour glass worms and under ideal loads and conditions.—G. H. Acker and C. H. Calkins, in *The Journal of the Society of Automotive Engineers*, Nov., 1926, p. 467.

Improved Airplane Engine Performance

Increased reliability of airplane engines is indicated by the results of a recent flight of one of the Navy's latest fighting planes, a Curtiss "Hawk" equipped with a Pratt-Whitney 400-hp. radial, air-cooled engine, known as the "Wasp." This plane flew from Washington to San Diego by the Southern route, up the coast to Seattle and back over the route of the air mail. The total trip was 7,000 miles and the flying time 65 hr. During the entire trip nothing was done to the engine except to remove and inspect spark plugs at San Diego. —*U. S. Navy Bulletin*, Nov. 9, 1926.

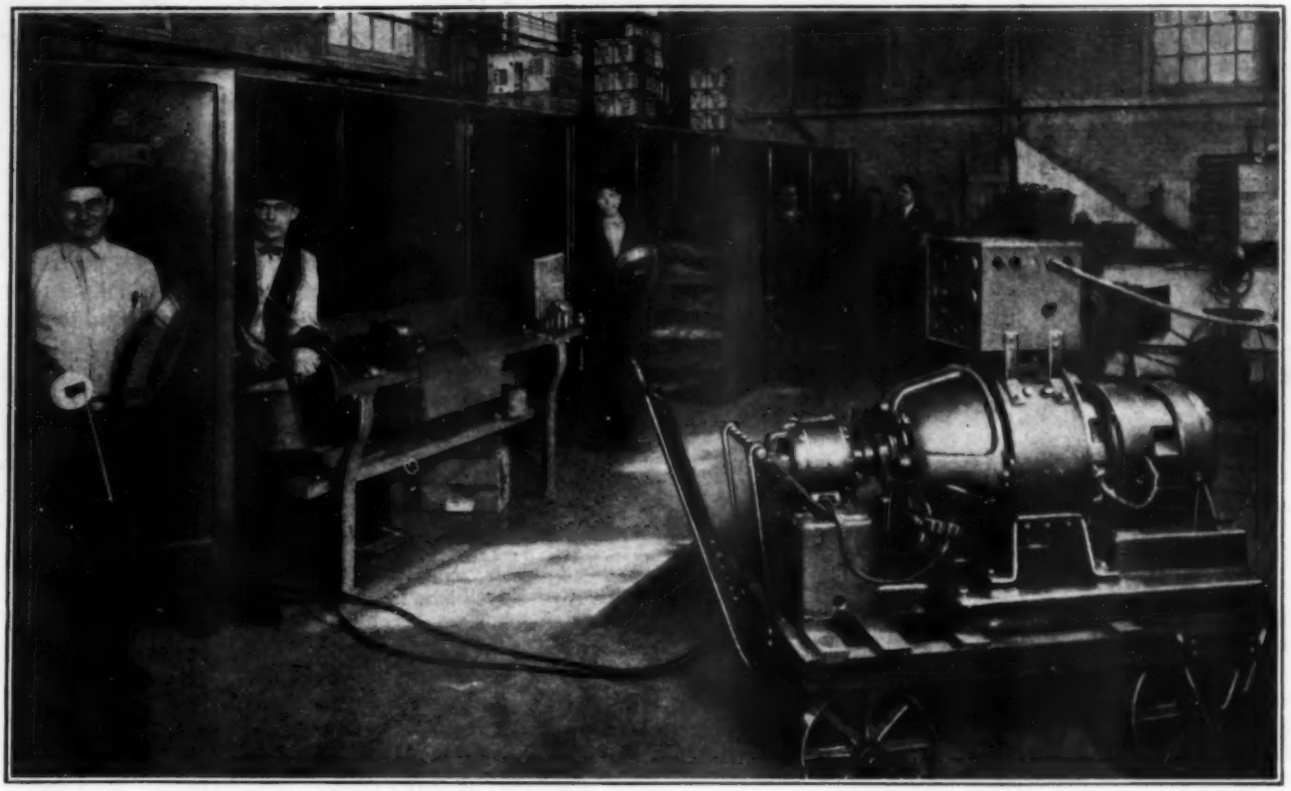


Fig. 1—An arc-welding set, and student welders at the Westinghouse welding school

Arc Welding as a Manufacturing Process

By A. G. Bissell

General Engineer, Westinghouse Electric and Manufacturing Co.

DURING the past few years the use of arc welding in manufacturing has been developed to a great extent, with the result that costs have been cut very extensively. The elimination of punching and riveting permitted the builder of welded tanks to cut his manufacturing costs until the riveted tank builder could no longer compete with him. This is also true in the manufacture of large-diameter pipe. Besides these prominent examples, there are hundreds of smaller industries that are now using welding in their manufacturing processes where no other method of joining metal parts could be used economically.

In order to utilize arc welding successfully in any industry, it is essential that the process should be thoroughly understood. Probably the greatest setback that arc welding has had has been due to the many misapplications and failures resulting from unfamiliarity with the process. The failure of the work usually is blamed on the process instead of on the operator where it rightfully belongs.

The first step to be taken in attempting to inaugurate arc welding in any industry is to employ a welding engineer. This man should be a man who has had considerable experience in the various welding processes, and who is broadminded enough to use the proper welding process where it is most suitable. His experience in other welding processes should make him capable of knowing how to extend the use of arc welding to its fullest extent. He should be given authority over the design of the work, and over the materials and equipment used. He should also be given the personnel of the welding department. In too many plants the individual foremen control the welding in their departments, and because they are not thoroughly familiar with the various phases of the work, the results are often unsatisfactory.

It is desirable to route all of the welding through a central shop if possible. In this case, the operators are within a limited area, and the checking of their work is simplified. However, if the work is scattered, the operators should be allocated to the various shops, but left under the jurisdiction of the welding engineer. A welding operator, moreover, should not be kept in one location, but should be moved throughout the whole system. In this way, all of the operators will become familiar with the various classes of work done in the plant, and the removal of a man will not mean inconvenience to any one department. This system also results in the operators becoming more experienced welders.

The selection of operators should be done by the welding engineer. It is sometimes preferable to train green men, and in this way obtain operators most suited to the requirements. A candidate should be young enough to be capable of absorbing considerable knowledge, and willing to do so. He should be a man who takes pride

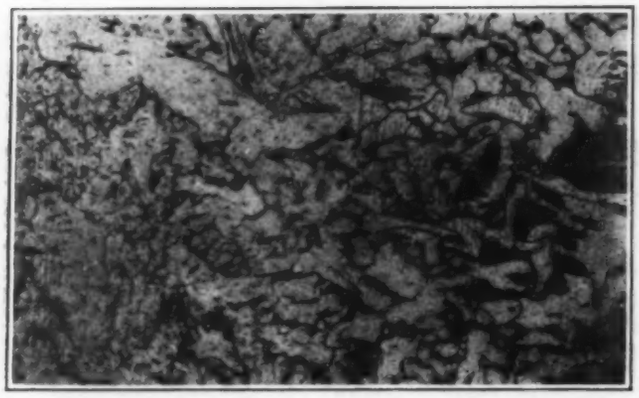


Fig. 2—Structure of an arc-welded joint

in his work, and he should be conscientious and willing to cut out and do over a job that he feels is not the best. Men of this caliber will soon build up their shop until there will be no welding problem that one of them cannot accomplish.

In order to assist customers in training their arc-welding operators, the Westinghouse Electric and Manufacturing Co. has a complete training school at its East Pittsburgh works. In this school men are given individual instruction in both the theory and practice of arc welding and cutting. Instead of a set course, an attempt is made to plan the student's work so that he may get the training most suitable for the class of work that he is to do.

The equipment used in the arc-welding process is illustrated in Fig. 1. In shops where many operators are to be employed within a small area, it is desirable to use multiple-operator equipment. This consists of a 60-volt, flat, compound-wound, direct-current generator driven by a motor. The size of this unit will depend upon the number of operators to be supplied with welding energy. The most common sizes have 500, 750 and 1,000-ampere generators. For the average work, these will supply sufficient welding energy for three, five and eight operators. It is possible to parallel any number of these generators, and thus obtain an unlimited supply of welding energy. The motor for these sets may be either direct or alternating current for any of the commercial voltages and frequencies.

When a single operator is to be employed, or the work is spread over a considerable area requiring the equipment to be moved from place to place, the single-operator, motor-generator set is employed. The generator on this set is of the differential compound type having an open circuit range of 45 to 70 volts. Its current range is between 60 and 300 amperes, which is obtained in 61 steps by turning a single handwheel on the control cabinet. When the arc is struck, the voltage drops to the voltage of the arc, making this the most economical form of generating equipment. When electrical power is not available, a generator is used belted to a line shaft, or direct connected to a gasoline engine or other power supply.

When using direct current, the positive side of the circuit is connected to the work upon which the weld is to be made. The negative side of the line is connected, by means of a special holder, to a steel wire. The latter is brought into contact with the work, then parted from it a distance of about $\frac{1}{8}$ in. An arc results that produces a temperature of between 2,000 and 2,500 deg. C. This intense heat, localized at the point of impact of the arc stream, immediately fuses a spot on the work into which the molten metal from the end of the wire is projected. The molten metal from the wire unites with the molten metal of the work to build up a deposit that solidifies as the arc proceeds. In this manner metal may be built upon a surface, or it may be deposited between two edges so that they are completely united.

The electrode wire is of hard-drawn mild steel of the following average composition in per cent: Carbon, 0.16; manganese, 0.56; phosphorous, 0.032; sulphur, 0.024; silicon, 0.016. In passing through the arc, this molten metal comes into contact with the air at the external surface of the arc stream, the extent of this contact being determined by the length of the arc held by the operator. The shorter the arc, the less the metal is affected by the atmospheric elements. At the temperature of the arc, the main elements of the air, oxygen and nitrogen, have a great affinity for the metals in the arc stream. The result of this affinity is that the nitrogen and oxygen combine with the elements of the wire to form oxides and nitrides.

The carbon of the wire combines with the oxygen of the air to form carbon dioxide and carbon monoxide. Both these compounds are gases, and unless they are entrapped in the molten metal, they escape. The oxides of iron, manganese and silicon float to the surface of the molten metal as slag. The phosphorous and sulphur are altered but little. The nitrogen combines mainly with the iron. An analysis of the metal of the wire after passing through the arc is given as: Carbon, 0.05; manganese, 0.18; phosphorous, 0.031; sulphur, 0.036; silicon, 0.011; nitrogen, 0.11 to 0.13; oxygen, 0.25 to 0.55. To prevent the introduction of impurities into the metal that is being deposited, is to make a good weld. By holding a very close arc, that is, between $\frac{1}{8}$ and $\frac{3}{16}$ in.; the arc stream is completely surrounded by an envelope, mainly of iron-oxide vapor, that prevents the active oxygen and nitrogen on the outside from coming into contact with the active elements on the inside, and permits a fairly pure metal to be deposited on the work.

By melting the steel wire and again solidifying it, we have produced cast steel, and at the same time altered the crystalline structure of the plate metal in the vicinity of the deposit. This structure blends into a coarse structure or line of fusion between the plate metal and the deposited metal. Where the two structures blend, fusion occurred at about 1,300 to 1,400 deg. C. The heat conducted through the plate away from the line of fusion produces structures corresponding to the temperatures reached. The coarse structure

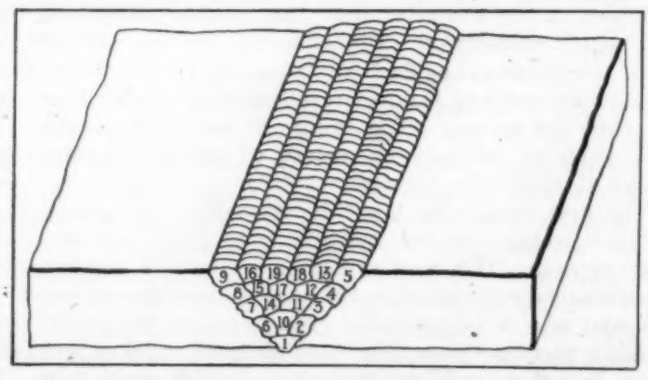


Fig. 3—Method of applying metal in arc welding

just alongside of the line of fusion is characteristic of steel that has been heated to 1,000 deg. or 1,200 deg. C. This material extends about 0.015 in. into the plate. As we proceed further into the plate, the grains grow smaller until the minimum size is reached at the point where true annealing occurred. Here the temperature reached is about 780 deg. C., or just above the critical point of the steel. Farther on the structure again coarsens, blending into the original structure.

It is not necessary, however, to allow this varied structure to remain in the work. An arc weld need not be a casting, nor is it necessary to anneal the work to prevent it, as some appear to believe. On metal ⅜ in. thick, or heavier, an arc-welded joint may be made that will have a structure similar to that shown in Fig. 2.

Where the plate material is heavy enough, the work may be deposited in layers composed of strings of beads applied directly to the face of the scarf as in Fig. 3. When one layer of the weld metal is completely deposited the cooling strains may be removed by peening, which stretches the metal. If a second layer of metal is then applied over the first, the heat will have a tendency to anneal the first layer.

It may be of interest here to discuss the theory of overhead welding. When the arc is struck on the work, the metal of the work and the end of the electrode wire begin to fuse. As the fusion continues, the metal of the work begins to sag and the metal on the electrode end forms a globule. When this globule is brought into contact with the molten metal of the plate it is drawn to the plate metal by capillary attraction.

The operating cost of the arc welding process is quite economical, since on average work where the operator has no moving to do and can keep steadily at his work, he will deposit about 2½ lb. of material per hour, consuming about 2½ kw.-hr. of electrical energy per pound of metal. Arc welding may be employed successfully as a manufacturing process providing it is properly supervised. The supervision is by far the most important phase of the process, and the supervisor should be capable of determining the caliber of his operators, and should know how each job should be prepared and what materials and current should be used.

Indicating the Right Lubricant

By G. B. Stuart

In these days of specialization, and of choosing the right machine and the right man for the job, we still frequently run across an anomaly in the form of the shop that uses a single oilcan for lubricating anything in sight. Modern machinery, with its great variety of high-speed parts, delicate automatic mechanisms, intricate gear combinations, and close fitting bearings, needs the right lubricating oil in the right place to get efficient operation, and the common shop oilcan does not fill the bill.

The sewing machine manufacturers long ago realized this point, and are emphatic in their oiling instructions to users of their machines. The builder of machine tools and special machines knows the best oil for the parts of his machine, but the operator is usually puzzled to know what to use. It occurs to me that the machine builder should put on the nameplate of the machine some indication of the type of oils best suited for the different mechanisms.

Seen and Heard

By John R. Godfrey

Testing flatness with gage blocks

THE time-tried plan of using tissue paper under a straight-edge to test the flatness of a plane surface is giving way to a newer and better method. Gage blocks are now being used in at least one shop where especially good work is desired.

The work in question is a flat disk, something over two feet in diameter, that is used as a thrust bearing under a heavy load. The material is cast iron. The disk is ground under a cup wheel and is turned over several times to eliminate all the stresses possible. The finishing cut is made with a fine wheel and a splendid surface is secured.

To test the flatness, a straightedge and four 1-in. gage blocks are used. The blocks take the place of the tissue paper of old. Placing the straightedge on the four gage blocks, the test is made by seeing if any one of the blocks is loose, as with the tissue paper. The advantage over paper, however, is that the method gives a positive means of measuring the difference, if any, at various points. By using a gage block that is slightly under an inch, and substituting it for any of the four blocks, it will readily show where the surface is out.

In the case mentioned a block a ten-thousandth less than an inch was used and it could be easily pushed out from under the straightedge in any of the four positions. While it isn't to be supposed for a minute that the surface was perfect, the test showed that the variation was less than the ten-thousandth. And that is nearer perfection than is needed for most work.

This question of perfect surfaces brings up the much disputed point about scraping. There is a growing belief that machines can be built to produce better surfaces than can be made by hand. The idea that a man with a scraper can dig off a little here and there and leave a surface more nearly true than one made by a good machine, is a relic of the days when machines were for less perfect work than at present. Any scraped surface is a series of "hills and hollows"—very slight, of course, but still there. Just what percentage of bearing surface is secured is not easy to measure.

True, the high spots may be more uniformly distributed than with a machined surface, which may slump off slightly at the edges. Then, too, it is possible that the low spots help temporarily by acting as minute reservoirs for lubricant during the wearing in process. But the aim is a full bearing, especially in cases where the surfaces are used for alignment, instead of for a moving bearing. Careful tests have shown that modern machining can be depended on to produce surfaces that require no further attention than to remove the "fuzz" or loose particles. Some modification of the honing process should replace much of the scraping now done.

In cementing belts have the cement quite hot—about 160 deg. F., is a good heat—but it should never boil. Rub it into both surfaces.

If blueprints are rolled with the blue sides out, they will lie much flatter on the desk or table when unrolled, than if they are rolled with blue sides in.

Educational Training for Industry—Discussion

By Ernest F. DuBrul
General Manager, National Machine Tool Builders' Association

IN SOCIAL activities, enunciated principles and actual practices are some times quite different things. And as this is the case in respect to many labor unions it is not out of place to point out that all unions do not practice the very excellent principles set out in this paper. Good management is glad to learn from forward looking union leaders that the unions are ready to co-operate in the task of raising industry to the highest possible degree of efficiency.

I am perfectly willing to believe that Mr. Woll's paper* expresses the sentiments of the select few; the best informed, and the clearest thinking among union leaders. But the practice of the many, who are ill informed, and whose thought processes are far from logical, does not as yet conform to these principles to such a degree as seems to be taken for granted by the author.

Much remains to be done by forward looking union leaders to win the rank and file, and especially the officials of local unions, to that same way of thinking. Forward-looking management will not disparage the difficulty that these leaders will have to overcome in bringing about this result. In doing so, however, it is not well to idealize the union nor to think it is now doing all that one hopes it may do at some distant date. If the author of the paper had made it plain that he has expressed ideals rather than quite exceptional realities, his paper would have a more constructive effect than it can have in its present form, before the present audience. A careful reading of the paper gives the impression that the author makes certain unwarranted assumptions on which he bases some generalities that detract from the value of the paper.

Perhaps the author's contacts have been only with unions that do realize the ideals he sets forth, and then again, perhaps he subconsciously, but nevertheless unduly, idealizes the unions he knows. Certainly the practices of the unions operating in the fields in which mechanical engineers most frequently function, are far from a state of conformity to the ideals expressed.

Some of the author's statements take in entirely too much territory, and are too sweeping in their generalizations to be applicable even to his idealized unions. Certain facts interpose themselves stubbornly in the way of acceptance of some of his broad statements. For example, he states that all workmen feel an urgent need for creative expression. Now it is a stubborn fact, known to not a few of his readers, that this is not the case. He then says that to fill this need the men naturally turn to their union. This is true, of course, in some cases, but having known many cases in which union membership was held merely because the workmen were coerced into doing so, many of us know that the realities are far from the author's idealization.

The author says: "The union sets and holds standards of craftsmanship in an industry." He also says: "It takes the responsibility of disciplining those who do not maintain a high quality of workmanship." If this expresses a belief that unions generally set worthy standards of craftsmanship, numbers of experts in management are in a position to disillusion the author. No competent manager would be willing to transfer the disciplinary responsibility for slack workmanship to a union. Experience shows that there is a responsibility of management that can not be transferred successfully.

The author is in grave error in making the broad statement that the union is the only agency in the industrial field exercising the standard-setting function in respect to craftsmanship. The idealizer of unions makes the wish father to the thought and its expression. Any experienced manager can show so many cases to the contrary that this generality falls into the class of statements that should never be made. Overstatement of this sort does the union cause no good before an audience of men so well informed on this particular subject as this one. In fact it would be a quite exceptional union that could function as the only agency in a very narrow industrial field for setting standards of craftsmanship that can reasonably be exacted. If the author's statement were true even to a very limited extent, it is not likely that industrial engineers, production men, rate setters, time-study men, inspectors and all such personnel would be drawing the pay that tight-fisted controllers of industry deem it advisable to give them.

*An abstract of this paper was printed on p. 951, Vol. 65, as part of the group of abstracts of A.S.M.E. annual meeting papers. These two discussions were read at the meeting.

Further Discussion

By Luther D. Burlingame
Industrial Engineer, Brown & Sharpe Manufacturing Co.

If one could be convinced that the activities outlined in Mr. Woll's paper represent a new and enlightened policy on the part of trade unions, it would go far to alter the feelings so many have, feelings engendered by long experience with what has seemed like quite an opposite policy.

In the more than forty years since my own apprenticeship in the machine shop, I have often been in contact with union activities, in union meetings, and at noontime union rallies at the factory. I have read much in union publications but have never yet seen the carrying out by them of the program here outlined.

I consider that the important steps so far taken in promoting industrial education are:

(a) School courses for apprentices during working hours.

(b) Evening industrial courses for those employed.

(c) Co-operative part-time courses.

(d) Technical preparatory day courses.

My observation and experience have not as yet shown cases where trade unions have been instrumental, either in this country or England, in organizing or furthering the work of these courses; rather, there has often seemed to be ill-disguised opposition to them from that source.

Because of such a policy in the past the suggestion that there be joint control in management by employer, the unions, and the public schools does not appeal to those looking to the best development of industrial courses. The question might further be asked why trade unions, constituting but 6 to 7 per cent of industrial workers, should be selected for such service.

It is certainly a new thought to many of us that the unions are the only "standard-setting agency" to maintain the standards of craftsmanship and that they are devoting their energies to "eliminating waste and increasing production efficiency."

Special Tools and Fixtures of the Rio Grande

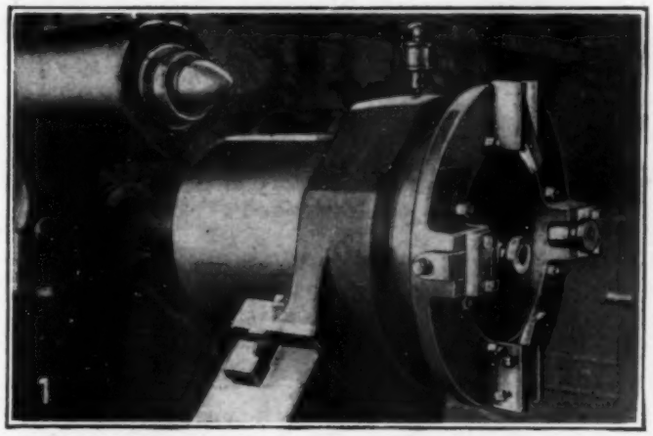
By L. C. Morrow
Managing Editor, *American Machinist*

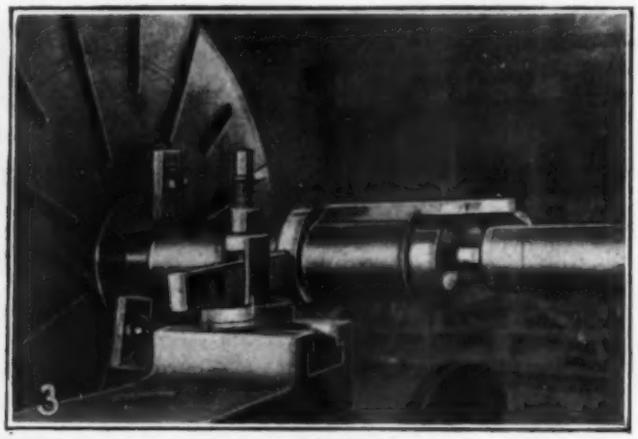
IN THE Salt Lake City shops of the Denver & Rio Grande Western Railroad the Niles quartering machine is used for turning and rolling crank pins. However, instead of using the ordinary two-tool head, and doing the job in separate turning and rolling operations, the combination turning-tool and roller holder shown in Fig. 1 has been designed and is being used successfully. Both turning and rolling are accomplished at the same time. The roller carriers are adjustable, and the rollers can be moved back out of working position when a roughing cut is taken.

Tumbling shafts, with brackets assembled, require lathes of extraordinary swing, when their bearings are to be turned. Even if the brackets will clear the ways, it is awkward and to some extent dangerous to have them revolving rapidly enough to give the required surface speed of the bearing at the cutting tool. A tumbling shaft in a lathe, with end bearing being turned, is shown in Fig. 2. The raising blocks are not necessary on the job as arranged; in fact they were not applied for the tumbling shaft job.

With one end of the shaft located by the tailstock center, the bracket blocked from the ways of the lathe, and the other end of the shaft centered by and clamped in the steadyrest, the end bearing is ready to be turned, as shown in Fig. 2, by the special tool designed for the purpose.

The special tool, Fig. 3, consists of an arbor with





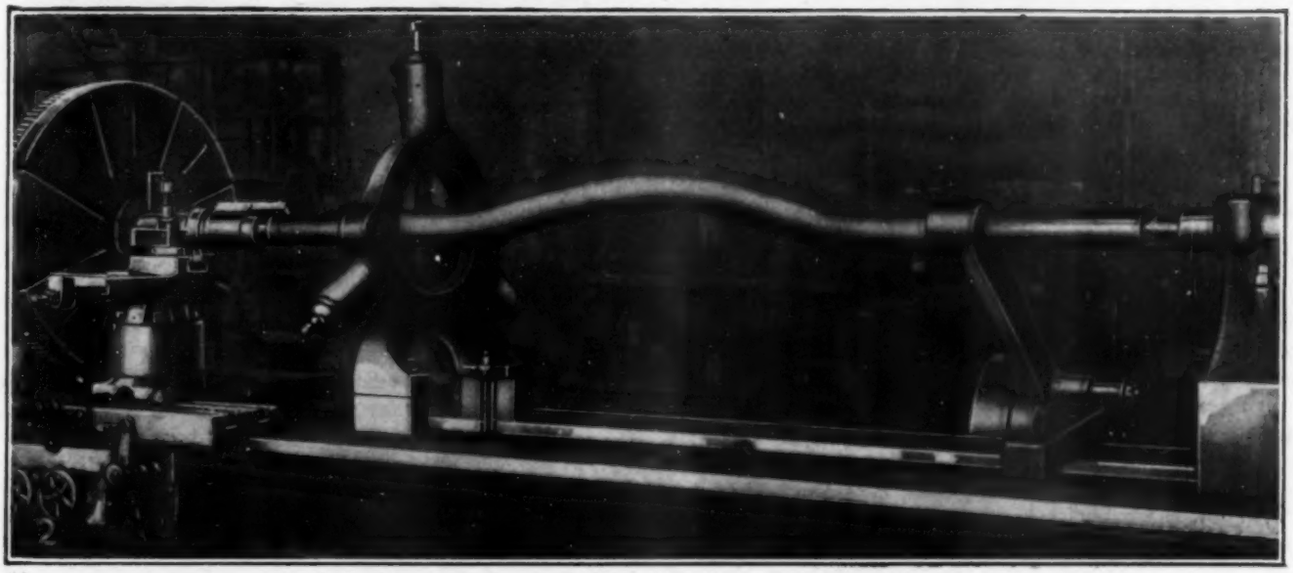
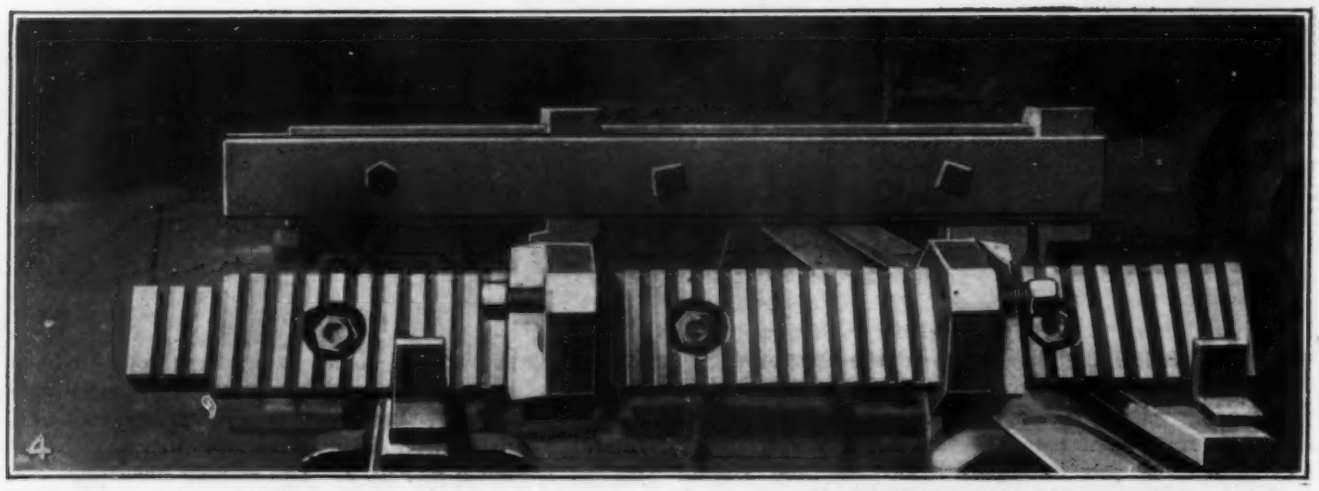
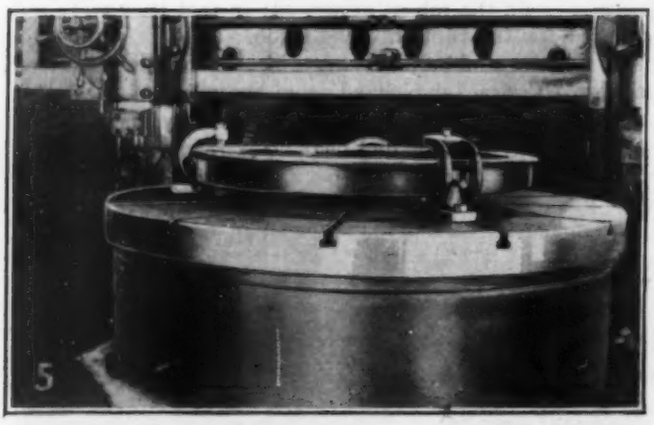
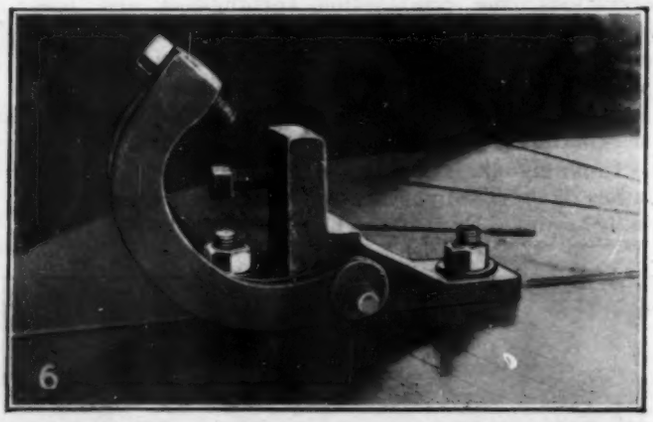
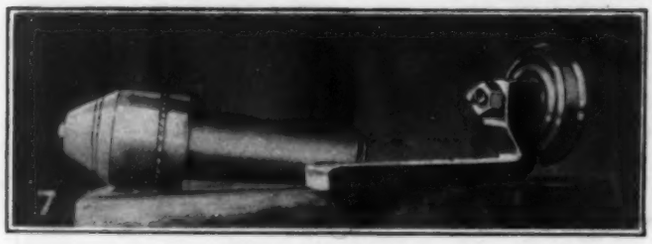


Fig. 1—Combination tool for turning and rolling crank pins. Fig. 2—Tumbling shaft in lathe. Fig. 3—Special tool for turning end bearings on tumbling shaft









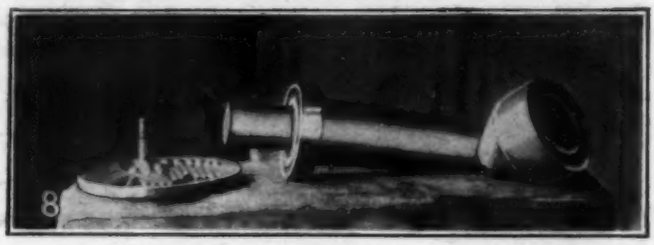


Fig. 4—Fixtures for holding rods on planer or milling machine. Fig. 5—Boring tire with flange up. Fig. 6—Tire clamp. Fig. 7—Combination ball and roller center, and journal rolling tool. Fig. 8—Center disassembled

a flange at one end by which it is clamped to the face plate of the lathe. It is located on the dead center of the lathe and itself carries, in the outer end, a center by which it is supported on the center hole of the tumbling shaft. Over the arbor there is a sleeve to which is welded the cutting-tool holder. A slot in the sleeve provides a track for the segmental shoe, by which the sleeve is moved along the arbor. The shoe is held in the track by a bar clamped in the toolpost of the lathe, and the feed is the regular longitudinal feed of the lathe.

Fixtures for holding connecting rods to planer or milling machine table are shown in Fig. 4, bottom and top views. The fixture bases are bolted to the machine table, one to support each end of the rod. The two clamps are then moved near the sides of the rod, pieces of key stock are inserted in the cross slots to back them up, the setscrews are tightened against the rod, end stops are driven into the table and the set-up is complete. Two rods may be mounted in a pair of fixtures.

Clamps designed to permit of boring tires with the flanges up are illustrated in Figs. 5 and 6. Three clamps are used in a set-up and centering is accomplished by means of the setscrews in the vertical, rigid members. The tires are held down by the setscrews in the swinging jaws.

To carry hollow driving axles while the journals are being turned and rolled, the combination roller- and ball-bearing center shown in Figs. 7 and 8 is used. The rollers take the radial load and the balls take the thrust. To dissipate the appreciable amount of heat generated in rolling, the grooved roller tool, Fig. 7, was devised.

Recent experiments in the treatment of locomotive and car parts show that properly hardened units will give an increase in wear and life over unhardened parts. Heat-treated brake pins, for example, have been shown by test to give a three-to-one life over untreated units.

Although both oxyacetylene and arc welding are becoming more common every day we are still a long way from standardized practice. Some claim good results from using bronze welding rods in locomotive frame work. Others contend that iron or steel is the only thing to use in such cases.

The Farmer Adopts Factory Methods

By Neil M. Clark

High costs have turned the farmer to automatic machinery—Drudgery has been eliminated—The farmer who spends most on machines is the cheapest producer

IT MAY be a mere commonplace in the near future to read in the same issue of the country newspaper adjoining "personals" to the effect that "Mr. John Smith on Wednesday started harvesting his 240 acres of wheat," and "Mrs. John Smith on Wednesday entertained the Ladies' Club at a luncheon and afternoon party." For generations on the farm during the dreaded harvesting time, the women baked, boiled and roasted in a blistering kitchen to feed a hungry crew of from five to a hundred men. Their new freedom from drudgery is only one incident in the new tide that is setting in in agricultural affairs. The farmer, today, is being guided by three chief considerations: a new attitude toward hired labor; a new understanding of the uses of power; and the astonishingly rapid acceptance of new farm machinery. Scarcely a branch of agriculture can be named that is not giving serious thought to the possibilities of cutting production costs by employing less labor, by utilizing power to better advantage, and by hitching power to new improved automatic tools and implements.

Before the advent of labor-saving machinery on the farm, the farmer's lot and that of his family was one of long hours and hard labor. No wonder that the boys and girls could not be kept on the farm. Now, by the use of marvelous labor-saving machinery the greater part of the drudgery has been eliminated

The primary factors in the situation are the decreasing supplies of farm labor relative to the increasing amount of farm work to be done; the lessening of the supply of raw new labor due to immigration restriction; the greatly increased wage rates demanded by such labor as is available; the cheapening of mechanical power, largely as a result of the satisfactory result of farm tractors; and the inventive ingenuity spurred on by these considerations, as well as by higher land values that make cheaper methods of production necessary.

In studies of the cost of farm production, the Department of Agriculture estimates that the total cost attributable to power and labor, represents sixty-nine per cent of the total cost of carrying on the farm business. In all cases where farmers have ceased to employ their own muscles as the chief source of power, and have substituted more efficient means, the result has been an increase in individual productivity.

Figuring the capacity of a strong man as one-tenth of a horsepower, and on the basis of power cost from horses or individual electric plants, the worth of a man as a motor is approximately 2.5c. per hr. At that rate in countries where human muscles furnish most of the power, 25c. may be considered a fair day's wage. Agricultural wages in the United States can be higher because farm labor is employed mostly on jobs of directing and supervising power, instead of producing it.

A few years ago, tariff protection was obtained for the rice growing industry of the United States. But, today, power and machinery are employed to such good effect in producing the crop that California rice, raised with $5 a day labor, can compete right in China with rice grown by the Chinese at 15-cent-a-day labor, moreover, many of the $5-a-day laborers in California are the same Chinese who earn 15c. a day at home. In spite of the present predominance of horses, the trend is strong towards tractors. In 1925 there were 506,745 tractors in use on the farms of the United States, the number having doubled in five years. Another dozen years may see two or two and one-half million tractors in use on American farms. In Illinois, the average sized farm is 135 acres, and there was in 1925 one tractor to every 5.1 farms. On a certain Iowa 200-acre farm two medium-sized tractors and one heavy tractor are employed to do every kind of field work, and to operate the thresher with increased profits over horse operation.

Speed is one of the tractor's merits. It has been found that two weeks' difference at the critical time for corn planting may make a difference of as much as twelve bushels an acre in the yield. If a late spring and wet weather delay the plowing time, the speed of the tractor can save the crop, and in a crisis the farmer can equip his tractor with a headlight and plow all night. A horse, of course, could not stand this extra duty.

Next to the tractor are the efficient new tools that it operates. It is conservative to estimate that the improved tools and machinery available for farmers, today, are at least ten years ahead of the average farmer's use of them. Some of the latest implements are proving so effective in use as to be considered nearly revolutionary, though, as yet, the country at large has scarcely heard of them.

Harvesting small grain crops involves, by ordinary methods, the several operations of reaping with the self-binder, shocking, loading on barges, hauling, stacking and threshing. Each operation necessitates an extra

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Abstract of an article in *The World's Work*, November, 1926, p. 49.

handling and a loss of some wheat. The harvester-thresher combine has only within two years come into general use. It performs all of these operations at once. It passes through the field cutting the grain and threshing it as it goes, and the grain is ready for the market the same day. A light tractor-drawn machine is capable of harvesting 35 acres in a 10-hour day. It is claimed that the combine reduces the cost of harvesting from 20 to 25c. per bushel to as little as 5c. per bushel. Moreover, with such cuts in production costs, it has been found profitable to raise grain on lands that had been regarded as not worth plowing.

Corn, too, now has a combine—the picker and husker—which does automatically what has been held to be one of the most disagreeable of farm jobs. This machine straddles the rows of corn and snaps the ears off of the stalks. The ears are carried up an elevator to husking rolls, which tear the husks off, and the clean ears of corn are dumped automatically into a wagon drawn alongside. The mechanical picker and husker, drawn by a tractor and operated by one man can husk 12 acres in a day, yielding about 500 bushels of clean corn.

Labor Forced Acceptance

The corn-picker is not a new-tool, but it had been sold only in limited numbers, despite all the force and expense put behind the sales efforts. Now the tables are turned, and the farmers who have had experience with the machine are making larger claims for it than the manufacturer. So long as the farmers were able to get a plentiful supply of cheap floating labor at harvest time, they felt no great need of a mechanical picker. But laborers began to be scarce, and it was this rise in the cost of hand picking that caused farmers to appreciate the advantages of machines.

Harvesting cotton by mechanical means is still a problem unsolved, although millions of dollars have been spent by experimenters. One difficulty is that cotton does not ripen in all the hulls at the same time. To develop a picker sensitive enough to select only the ripe cotton and leave the unripe, seems like asking for a super-machine, but the economic need is enormous, and it is believed that there is one picker developed to the point of proving sound in principle, that will do for cotton what the corn picker does for corn.

In market gardening the farmer found that women on their knees weeding, made onions and cabbages cost too much. Later, when the green immigrant labor had to be paid $5 a day, the mechanization of the gardens set in. Now a man operating a tractor with a planter attachment, plants three rows of onion sets at once, finishing an acre in two hours, a job that would require three days of hand work. Potatoes are now planted, cultivated and harvested by tractor-drawn machines. Orchards are now equipped with a central spraying plant so that the farmer, with a twist of the wrist, can spray his entire orchard and save his crops from pests at a critical time.

The savings with machinery on the farm are enormous. Cheap labor is not likely to return to the farm, and the farmers know that henceforth they must give as much thought to producing cheaply as to selling dearly. They must use power with the same degree of effectiveness as does the manufacturer. In fact, the farmer who spends most per acre on modern machinery is the cheapest producer.

The Metric System Again

By H. B. Schell

The perennial question of the metric system of weights and measures has put forth its bud and blossomed again. The argument advanced by the proponents of the system is that sizes would not be changed, merely designations. In other words, a shaft 1¾ in. in diameter would be known as 49.2116 mm. Very simple, indeed.

If present sizes are to be retained and merely designations changed, it would appear to be considerably more burdensome than to have things as they are. For instance, the width across the bed of a certain machine is 34½ in. and, working from the center line out, is 17¼ in. The calculation can be made mentally by anyone. Metrically, the dimensions would be expressed 876.28275 mm. and 438.141375 mm., which isn't quite so simple.

Of course, so far as sizes are concerned, we could say 876.25 mm., and that dimension might be used for making a repair part to fit the old machine, as the error, expressed in inches, is 0.00129. The great burden of this arrangement, however, would be the necessity of keeping both systems in mind. In other words, the users would be continually attempting to think in inches and speak in fractions of meters.

It is not so much the vast and increasing number of machines that are built to the inch system, great as that factor is, that must be considered, but rather the source of confusion that will come from the minds trained in the inch system. Men who have used the metric system for years, and are still using it, find themselves unable to think in it. Just why this condition should exist is not apparent, but that statement has been made repeatedly.

What disposition, then, would we make of the inch-trained mind? What remedy is there for the mind that cannot conform to the new measure, the mind of the engineer, the draftsman and the clerk, men who do the world's mental drudgery?

Indeed, it would be comparatively easy to change over the machine designations, but the mind will not conform quite so readily. Laws may change the unit of measure, but they can never regulate mental processes.

Decimals Are Used

There is no question as to the desirability of some decimal system. The writer was employed, some years ago, in the engineering department of a concern whose product, including production tools, was made to the decimal system. Nothing more convenient could be imagined than the use of drawings with fractions of an inch expressed in decimals. Compare this with figures in four units of measurements, viz., eighths, sixteenths, thirty-seconds and sixty-fourths, not to mention halves and quarters. The advantage is at once apparent.

Furthermore, when greater accuracy is wanted, the decimal system is always resorted to.

Were the history of the industrial development of the United States turned back 150 years, and we stood on the threshold of our career, nothing wiser than the choice of some such system as the metric could be enacted. To attempt to change now would be to bring about such a state of confusion that "Old Man Chaos" would sit back and rub his hands, and chortle in fiendish glee.

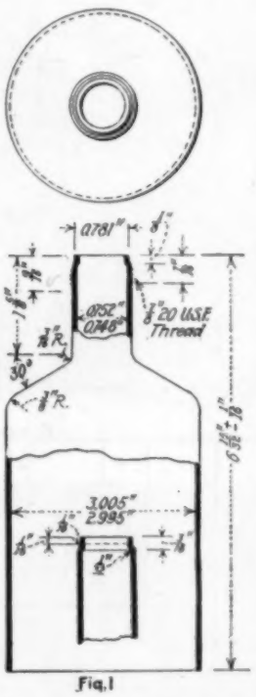
Dies Draw Supply-Tank Body to Shape

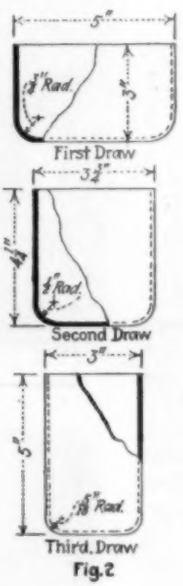
By Frank W. Curtis
Western Editor, *American Machinist*

Sequence of operations and dies required to form shell—Type of die used for six neck-drawing operations—Air-operated mandrel used for threading

SUPPLY-TANK bodies, a part of the operating mechanism of the Lockheed hydraulic brakes, manufactured by the Wagner Electric Corporation, St. Louis, Mo., are made of sheet metal, 0.065 in. in thickness, to the sizes shown in the part drawing in Fig. 1. Nine drawing operations are required to draw the two cylindrical portions, 3 and $\frac{3}{4}$ in. in diameter respectively, which form a bottle-like unit. The evolution of the work from the blank to the finish-drawing operation is shown in Figs. 2 and 5.

Blanks, 8.375 in. in diameter, are cut from strip stock that is obtained sheared to the proper width and in 12-ft. lengths. The blanking die consists of a punch and a ring die mounted in cast-iron shoes. Three drawing operations are required to form the body of the tank as illustrated in Fig. 2. The first drawing die, Fig. 3, is provided with a drawing ring *A* that has a shallow counterbore cut in its upper face to locate the blank *B*. The sizing portion of the ring is $\frac{1}{4}$ in. in height, under which an undercut is provided so that the formed cup *C* will be ejected from the punch on the upward stroke of the press. The pressure pad *D* is used to prevent the metal from wrinkling. In the original layout of operations it was intended to accomplish the blanking and the first drawing of the work in one die but to suit the available press equipment the separate operations are used.





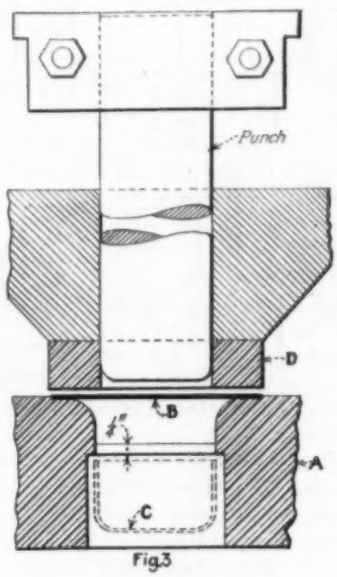


Fig. 1—Details of finished tank. Fig. 2—Three drawing operations required for body. Fig. 3—Details of first drawing die

Prior to the second drawing operation the work is annealed at 1,200 deg. F. to remove strains and hard spots. In this condition the cups are drawn in a die, similar to that shown for the first drawing operation, in which a shell 3¾ in. in diameter and 4½ in. in depth is produced. The presses used for the first and second drawing operation are operated at 9 r.p.m. and a production of approximately 540 pieces per hr. is obtained. An additional annealing is given, after which the third drawing is made in the die illustrated in Fig. 4, which completes the size of the body to 3 in. in diameter. On the die shoe are shown pieces before and after being drawn in the die. A No. 60½ Bliss rack press, operated at 6 r.p.m., is used. The production obtained is approximately 360 pieces per hour.

Details of the six neck-forming operations that follow are shown in the layout in Fig. 5. At *A* is shown the drawing ring and punch used in making the first neck draw, while in the layouts of the succeeding draws may be seen the details of the punches used. The dies used for all draws are similar in construction with the exception of the rings and the punches. In Fig. 6 are illustrated constructional details of the die arranged for the final necking operation. The work is placed on the punch *A* so that its body fits over the punch ring *B* and the punch support *C*, which are separated slightly when the press is in a neutral position. When the drawing die *D*, mounted in the ram of the press, is lowered it draws the work to size over the punch. Ejection of the work is accomplished by the punch ring and knock-out plate *E* which are raised by the adjustable screw attached to the crossbar *G*. The crossbar is connected by two rods to the drawing die as shown. Six knock-off pins located between the knock-off plate and the punch ring are used to complete the

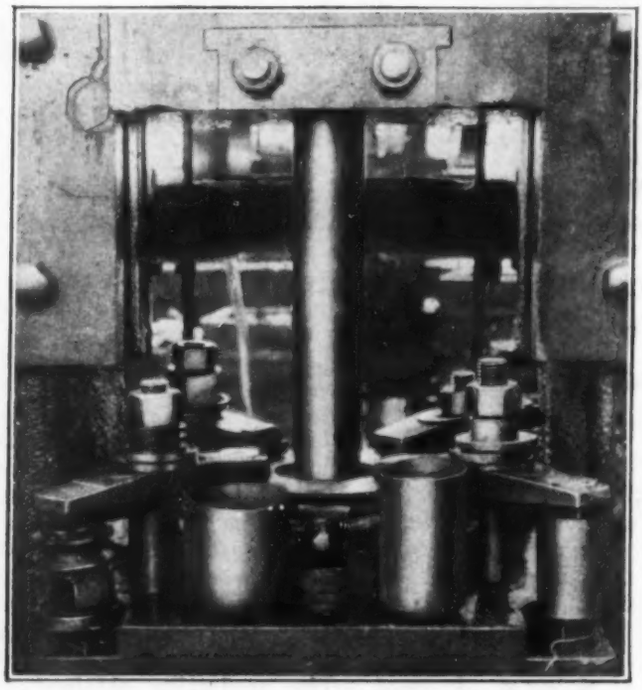


Fig. 4—Final drawing operation of body

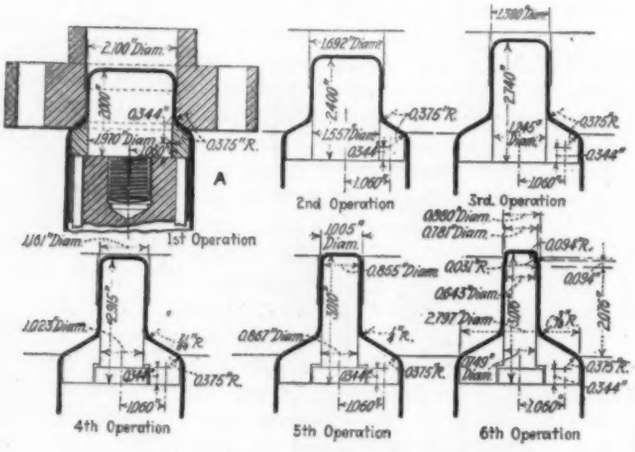


Fig. 5—Layout of neck-forming operation

ejection. The end of the work is dipped in a soap solution before it is drawn. The average production obtained is 500 pieces per hr. and the presses used are operated at 21 strokes per minute.

After the first neck draw has been completed the work is trimmed in the die shown in Fig. 7. The cup is placed over the horn *A* so that the inside of its crown strikes the adjustable work stop *B*. In this condition the edge of the cup strikes the spring plunger *C* which is retarded accordingly. The die insert *D*, details of which are shown at *E*, is locked in the horn by its 10-deg. face when the horn is drawn against the hardened ring *G* by the nut and washer at the rear side. Details of the punch assembly are shown at *H*. After the first section of the portion to be trimmed has been punched out, the work is revolved by hand until the far edge of the cut strikes the plunger which moves outward as the work is turned. In this position the plunger acts as a stop gage for the succeeding trimming strokes. In Fig. 8 is shown the die in operation.

An additional annealing and pickling operation is

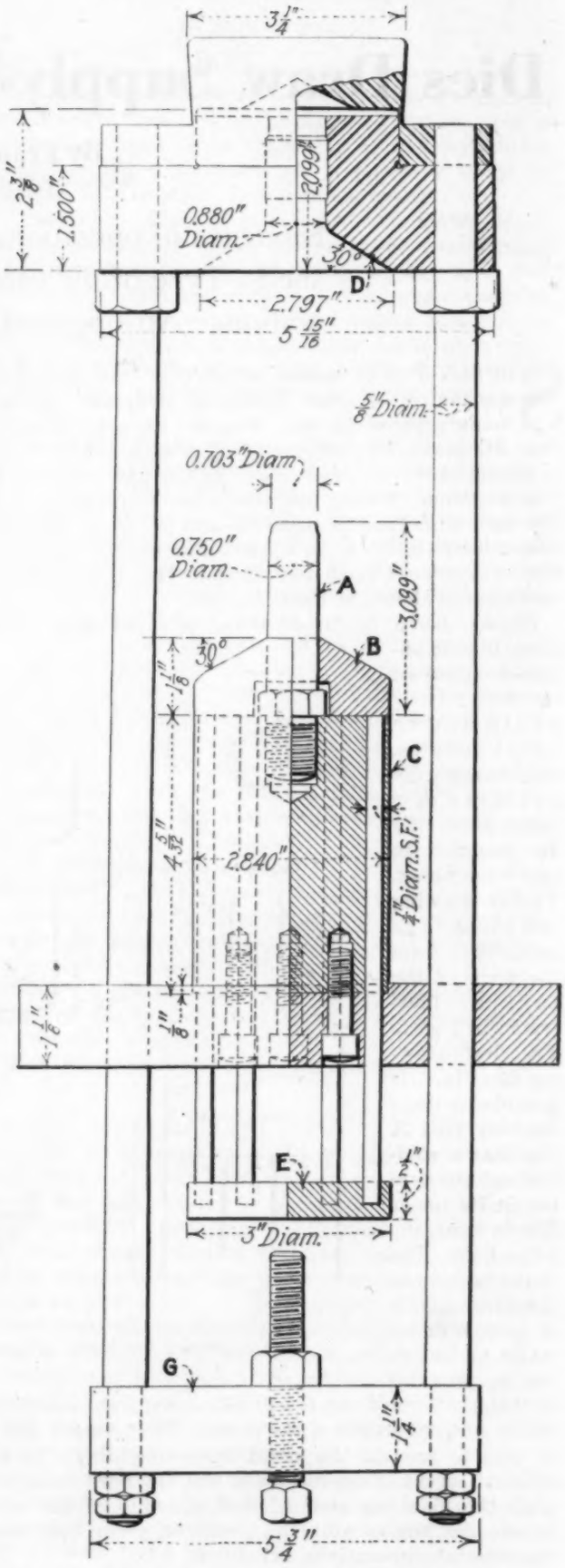


Fig. 6—Details of pillar press used with different punches and dies for the neck-forming operations

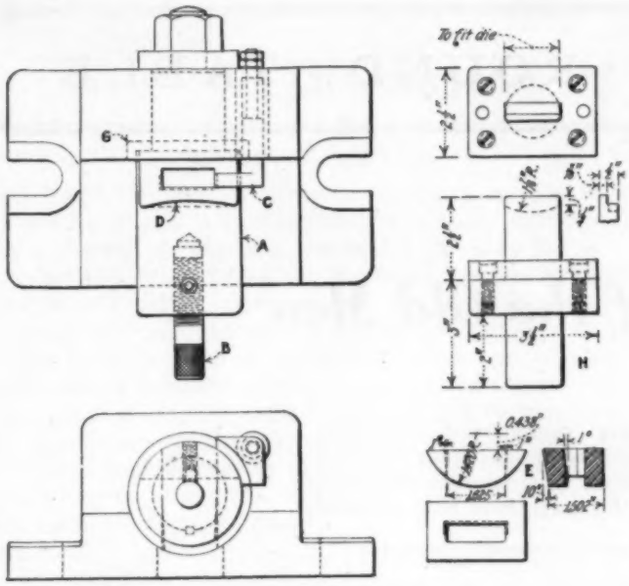


Fig. 7—Details of trimming die

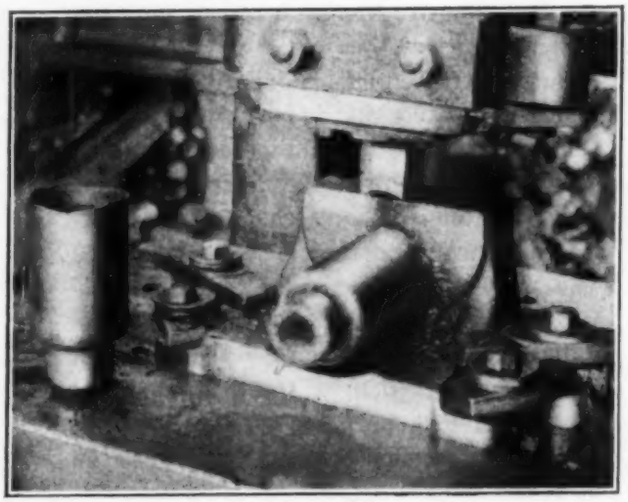


Fig. 8—Trimming die in operation

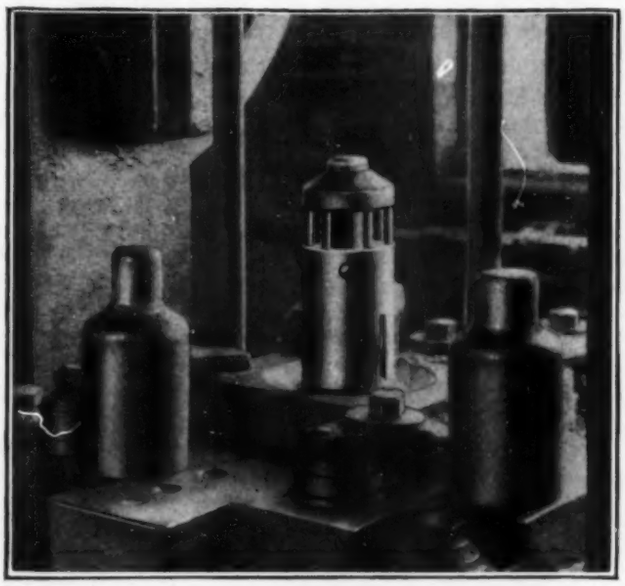


Fig. 9—Die used for fourth necking operation

required after the completion of the fourth necking operation in which the same procedure is followed as in the previous cases. The fourth necking die is shown in Fig. 9 with a finished piece standing at the left of the die.

The final operation, that of turning, facing and threading the neck, is performed in a No. 4 Warner & Swasey turret lathe in which the expanding mandrel

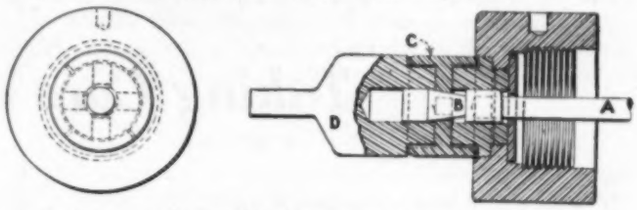


Fig. 10—Air-operated mandrel for threading end

shown in Fig. 10 is used. An air cylinder is connected to the push rod *A* which has a tapered expander *B* fastened to its operating end. Inward movement of the rod and expander operates four jaws *C* that grip the work from the inside surface after it has been placed on the nosepiece *D*. The mandrel is fastened to the spindle of the machine by the adapter.

The Proper Use of Wrenches

By R. H. Kasper

There seems to be a general belief among machinists and other users of wrenches, that the harder a nut or screw is pulled up the better it will hold. The use of a pipe or other extension on a wrench handle has therefore become quite a general practice.

The use of any other than the standard length of wrench handle, however, should be avoided, for a number of reasons. In the first place, the maker of the wrench has proportioned it so that a man of ordinary strength and weight may draw up the screw as tightly as it should be drawn without undue exertion. In the second place, the threads of a screw and nut are capable of withstanding only a certain shear strain, depending on the size of the screw.

In the third place, the body of the screw which is subjected to tensile stress when drawn up tightly, is deformed somewhat by the tightening process, becoming longer and reduced in sectional area. Though this deformation, which is characteristic of all metals subjected to tensile stress, is small under ordinary conditions, it may become quite pronounced by excessive tightening. Until the elastic limit of the metal forming the screw is reached, this deformation is but temporary, the elasticity of the metal permitting it to return to its original condition when the strain is removed. When the elastic limit has been reached the deformation becomes permanent, and a screw that has been drawn up to this point becomes dangerously unsafe.

It must be borne in mind that the screw is subjected to the strain as long as it is in use, and, although it may show no signs of weakness, its strength has been reduced to such an extent that it may be incapable of sustaining the weight or withstanding the shocks to which it may be subjected in the operation of the machine. It is safe logic to reason that, if the screw will not hold the part securely with ordinary tightening, an additional support is required for the part, or there is something wrong with the design.

THE · FOREMAN'S · ROUND · TABLE

Taking Care of the Old Men

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the bottom of this page have been prepared

"WHAT'S got into Williams, Al? Looks like he was trying to run an old man's home in the corner of shop three."

"Does sort of look that way, Ed—but Williams generally knows what he's doing, and I guess he does now."

"But what's the idea of gathering all the old timers into one place? Seems to me he'd get more work out of 'em if he kept them mixed in with the production gang."

"Williams talked to me about it awhile ago, Ed. And I like his idea of taking care of the men as they get old. He's a good-hearted chap, Ed, and he don't believe in ditching a man who has given his best years to the firm.

"So Williams studied the question all over and decided the best thing was to take the old men out of the production gang, where the hurry and rush gets on their nerves and makes them feel as though they weren't of much use. He's got them on salvage work just now, and they are happy over it. They're doing a good job, too, Williams says."

"But isn't it a kind of favoritism—won't the other men feel that it isn't fair, Al?"

"Ed, any man who kicks because the firm tries to take care of its old timers hasn't got much of an idea of fairness. All they have to do is to wait and they'll be elected to the same privileges. And there's another side to it, Ed. Taking the old men out of the production gang has speeded the work a little—there's no longer the alibi that 'the old man can't keep up.' "

"Why not pension them, Al, and keep 'em out of the shop?"

"Two reasons, Ed. One is they can earn something for the shop and don't feel that they are dependents. Next, they are usually happier in the shop than getting under-foot around home and trying to kill time. It takes a firm with a husky reserve to pension a man. Almost any shop can work this plan."

Was Williams wise in segregating the old men?
How would it work in the average shop?
Is it better than asking a good mechanic to be a sweeper or a night watchman?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Saving a Man's Face

IN TRYING to correct an otherwise good worker who was habitually late or inclined to be fussy over some jobs, I have always been successful in using the following method, provided the workman involved was of any value at all.

Study the man's actions carefully and be sure that he is really in need of correction. Call him to your office and in a matter-of-fact, unprejudiced manner tell him frankly of your objections. Explain to him why his actions are wrong, why he cannot receive privileges denied to others, and why there is a need for promptness. Advise him if he is fussing unnecessarily with his work. Perhaps he doesn't realize it.

Let him know that as long as you are foreman any questions of such a nature will receive prompt attention. Tell him that his work and actions are otherwise satisfactory and acceptable. Don't forget to warn him that to continue his bad habits will be to invite a transfer, reduction in wages or even dismissal.

I have had similar cases with almost every type of workman and the result invariably has been improvement. There may be times when it is unsuccessful but I have not experienced that as yet and my experience covers several years as foreman and executive in several factories. What I have said does not mean that in every case the man became satisfactory. Transfers have been necessary and there have been a few dismissals but there has always been an improvement. The exceptions were always undesirables. —DAVID E. SPEER, *Superintendent.*

Saving a Man's Face

THE subject "Saving a Man's Face" is one on which it is impossible to dogmatize unless it is to state emphatically that no two individuals will respond to the same treatment in the same manner. The ideal foreman will need to study the idiosyncrasies of each of his men. He will not regard it as time wasted, knowing, as he must, that those who consider labor merely as a commodity or part of a complex mechanism quite inanimate will in time lose their hold on their men.

The most drastic and outspoken censure before his fellows may be the most appropriate medicine for those hearty and well-intentioned but happy-go-lucky people on whom a mild reproof would have as much effect as the proverbial water on a duck's back. The same words of censure, however, applied to a sensitive worker would render him a permanent enemy only awaiting his opportunity to quit or to injure the shop morale.

Always know your man and never antagonize him. The loyalty of the men under you is materially influenced by your treatment of them. You can have their regard, even their affection, but it must be coupled with their respect which can be had only by studying them. —G. W. TRIPP, *Engineer, England.*

Saving a Man's Face

THE solution to the problem of disciplining men depends upon the class of men employed under the foreman. If the men are of the foreman's own choosing they will frequently be of a caliber similar to that of the foreman and he should deal with them as he would like to be dealt with under similar conditions. Sarcasm and ridicule cannot be used in calling a man down, for they show only lack of tact and ignorance on the part of the foreman.

If a mistake or error is a pure mistake, then the less said about it the better. If it is a careless error then the attention of the man who committed the error should be called to it. In such cases I usually tell him that he is not paying sufficient attention to his work or that he shows a lack of forethought which might be remedied by studying the technical magazines at home so that he is better fitted to handle his job.

Breaches of discipline should not be overlooked. If a man is worth keeping he will not commit many breaches. A man who wants greater privileges than anyone else should be let go at the first opportunity. In correcting a man, the foreman should never allow his "bawling out" to be overheard.

I find that the persuasive and co-operative method of correcting a man helps far more than the "PDQ" system which always leaves a bad reaction. I have served under both systems and know what it does to the personnel. A clap on the back always made me put greater efforts into my work and when that clap was not forthcoming I usually felt a little relieved and like taking things a little easier.—H. MAPLETHORPE, *England.*

Keeping Men Interested in the Job

IT IS distinctly worth while to arouse a man's interest in his work. A man who is at all worth having possesses a considerable amount of self interest. If you do not arouse his interest in his work so that he will see the advantage of applying his self interest to his work, then you neither get the full benefit of that man's ability nor will you hold him for long. His self interest will seek an outlet in another shop or another line of work. But, get his interest aroused in his work,

THE · NEXT · TOPIC

Helping Your Men Get Better Positions

QUESTIONS

Would you tell a good man about a better job in another shop?

Is it fair to the firm if you do—or to him, if you don't?

Can he and will he help to sell your product?

THE · FOREMAN'S · ROUND · TABLE

and you are sure to make him a loyal, valuable link in your organization. You will have to play fair with him.

To arouse his interest, you must literally, "sell" him the organization, the product and his present job. The foreman is perhaps the biggest factor in this, as he is the contact between the mechanic and the organization. The first step, and the biggest, I believe, is for the foreman to convince the mechanic that he is a "square-shooter." A mechanic's training and experience with life are such that he cannot readily hang his loyalty on an intangible impersonal thing such as an organization or a product. He must first feel loyalty toward something more "alive" and that is usually the foreman. The foreman provides the ever necessary human element. He becomes his guide, philosopher and friend. Having earned the mechanic's confidence, the mechanic will be more than eager to follow his friend's instruction and share his enthusiasm in the work at hand.

Of course, there are many men in the shop who know what is going to become of the parts they are working on, but no matter how many there are, there are not nearly enough. Actually, every man in an organization should know. If he is to do his work efficiently, if he is to hope to have something more than a mere job some day, he cannot neglect this important knowledge. If we do not arouse his interest sufficiently for him to know this, we are merely employing his hands and not his head. We are getting the services of a human machine, but not of a man. So it is vitally important for the foreman to see to it that a man knows what is to become of the parts he is working on, and what part they play in the finished product.—E. L. FARRALL.

The Foreman's Main Job

AS NO business can run very long if it does not make a profit, Al is right in saying that the foreman's main job is to earn profits for the company. After the rates have been set on the work to go through the shop it is the foreman's job to see that the schedule of production is maintained at these rates.

The office has its job in keeping a check on the cost of similar jobs done in other factories and in checking up on the selling costs of the product. Since they are not out in the shop it is up to the foreman to keep a check on his production rates, expenses for repairs and cost of supplies.—THOMAS M. GARRY, *Foreman.*

Saving a Man's Face

A FOREMAN'S personality should be such that at no time is there any doubt in the mind of the employee as to the carrying out of his instructions. Stating orders in a clear and concise manner is very difficult and requires study and practice. The writing of orders frequently saves mistakes and misunderstandings.

The foreman should be able to convey to the workman the idea that he is personally interested in every piece of work in the department. This will put the intelligent workman on his honor and he will take pride in showing his foreman that the confidence is not misplaced. If a workman does not conduct himself properly it is the duty of the foreman to coach him rather than to bawl him out.

I approve of showing a man where he is at fault but feel that "cussing" a man is uncalled for and unnecessary. Such tactics will not reform a man nor correct any real evil. If a man cannot conform to his instructions and if he performs his work indifferently, he should be replaced.—NEIL MCLEOD.

Saving a Man's Face

THE "calling" of any employee should be a matter of considerable study on the part of the foreman. The tact or lack of tact in "calling" a man has often made a success or failure of the foreman's career. Some employees are prone to take advantage of the other men in the same manner that a thief takes advantage of the ones whom he robs. If the foreman nips the habit of time stealing in the bud the employee is less likely to become a professional time thief. The employee should be reasoned with and made to see the effect that his continual tardiness has on his fellow workers.

Regardless of how efficient a workman is, it will be far better to do without his services than to establish a chaotic condition in the shop. Without discipline no shop can be efficient. If the workman does not comply with a suggestion, then he should be given a final warning that if his undesirable conduct is not corrected he will be dismissed.

Some employees need a most severe bawling out in order to secure results. By no means can all men be properly handled by "cussing" or threatening. But neither can all men be handled by using mild words or reasoning. It is absolutely necessary, therefore, for the foreman to know his men through a thorough study of their habits. Proper handling of men creates loyalty to the company.—H. E. FISHER.

The Foreman's Main Job

NO MATTER how altruistic we think we are, we can't get away from our old friends Profit and Loss, for if we can't sell our product at a profit, we go out of business and that doesn't mean that just the Boss quits, but that everyone on the payroll has to quit.

Nowadays many of us like to kid ourselves and others by piously disclaiming that we are in business for profit, we have a lot of phrases going the rounds about "Service," that we are in business to render service to others, etc. Personally, I think if we analyze right to the bottom, the very scheme of existence is based upon "Profit," the profit of any living thing being the reward of life itself, or just plain living, the ability to survive. As existence becomes more complex, the situation becomes more involved and there are many ramifications. You make something that I want, and won't give it to me until I give you something that you think is more valuable than that which you already have. Thus

THE · FOREMAN'S · ROUND · TABLE

we go on up the scale to our present plane of existence, and the present-day industrial system.

Al is right about profit being the most important thing to consider, for our very scheme of existence depends upon there being a surplus, something left over. If there isn't, the present-day scheme of living decrees that we go out of business. The man in the shop may not worry his head about the boss' profit but just the same it's this very same profit or surplus that enables him to keep his job, and if someone doesn't do a little worrying about it, there won't be any job.

Every foreman and every workman ought to be keenly alive to this necessity, for, in the final analysis, it determines his status of life. Most any foreman, or any of us for that matter, can influence the success of the department or business just by the simple expedient of imagining that he owns it, and that the wastes and mistakes come out of his own pocket, or rather, act to deprive him of something he wants. Of course, we won't all of us have this attitude and very few of us ever do have it, but if we did, what a whale of a difference it would make, and what a lot of wrinkles would iron themselves out of the boss' face. Almost without exception we take our cue from the daily actions of those to whom we are responsible, and the actions and thoughts of a foreman are reflected in his men. If he is interested in the financial well being of his employees, they will reflect this attitude.—GRANDON D. GATES.

Saving a Man's Face

VERY little constructive planning has ever been done under the influence of passion. Under such conditions there is a pressure exerting itself that bears down the tendencies for careful consideration. Abusive language, loud talking and shouting at an individual in any way in the presence of others when it can be avoided, usually indicate anger. The degree can be determined by the manner of presentation.

Men do not reason well when angered even though the degree of anger is very small. The foreman must be very considerate when he is correcting a man under his control. Of course, there are instances when words of correction must of necessity hurt a man's feelings but if they are delivered with a broadminded attitude on the part of the foreman they will usually be accepted with good grace and will not leave a revengeful feeling on the part of either.—JOHN MARK MAY.

The Foreman's Main Job

SINCE practically all executives of this day and age are agreed upon the proposition that the average workman puts out more and better work when led than when driven, it seems incredible to me that this matter should still keep bobbing up in shop discussions. The issue is a dead one.

As to the successful foreman's interest in the "profits" of his department, in dollars, I should say that this interest need be practically nil. It is the exceptional man who is in a position to know by what margin his department is producing at a profit. It is doubtful whether Al can requisition a casting, machine it, and turn it over to the assembly department with even the vaguest knowledge of the actual "profit" derived from his part of the task.

I feel quite confident that Ed can make his department a success without giving even a thought to that remote term "profit." His watchword should be "Efficiency." If departmental efficiency is high, then profits will take care of themselves.—A. M. MORRIS.

The Foreman's Main Job

OF COURSE, Al was right in saying that profit is the most important part to be considered. What Ed could not see was that by "being up to his neck in all sorts of things," he was merely attending to the necessary factors that go to make profit. The two principal factors are the quality of the product and the quickest and most economical way to do the job with the facilities at hand. There are also the contributing factors of leadership, resourcefulness, tolerance, cheerfulness, discretion and a few other things than any healthy-minded man's conscience should keep to the front.

Again, Ed's remark about "letting the office do the worrying about profits," showed lack of intelligent thought. The office has to do its share as has every member of the organization down to the mechanic himself. A foreman's influence in securing profits is limited only by the degree of his management's confidence and its general policy toward the employee, whether it is fair dealing and square or slave driving in character.—T. R. SARGENT, *Foreman.*

Saving a Man's Face

IT IS much better at all times and under all conditions to avoid the public reprimanding of an employee. If a man has been infringing the rules of the company, he is the one that should know about it and not the rest of the force.

Publicly reprimanding a man not only antagonizes the offender but also tends to arouse sympathy in the minds of the other men. The subject will probably be much discussed when the foreman's back is turned. Then again, it is much better to ask the man to come into the office and sit down so that a direct appeal can be made to his honesty and loyalty. A word to the wise is usually sufficient. Such treatment will rarely fail to produce the desired results and will not lower the dignity of the foreman. If such treatment does not produce the desired results the man should not be retained.

Should other workmen observe that the man is in the office in conference with the foreman they can usually be relied upon to draw correct conclusions, especially when they know that the man has been violating the rules. Loyalty to the company will not suffer if the men are led and not driven. There is something buried deep in the human breast that rebels against belligerent tactics.—RAYMOND W. HICKS, *Instructor.*

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Press Tools Save Material and Time

By George H. Feltner

Recently I saw some press operations for making a gear assembly which are somewhat uncommon. Savings in material and time both are prevalent in the method to be outlined.

In Fig. 1 at *A* is illustrated a gear that formerly was made of bar stock 1 3/16 in. in diameter. At *B* is shown the screw-machine blank that now is used to produce it. The first press tool swages the blank cold to the shape shown at *C*. A coining press, having a 400-ton pressure, is used for the operation in which solid dies are utilized. The teeth are then blanked, after which a shaving operation follows. In Fig. 2 at *A* is shown the die for blanking the teeth. The hub of the gear fits into the punch *B* for location. The stripper *C* ejects the trimmed portion from the punch. The assembly illustrated is mounted in a guide-pin die-shoe assembly. The die is shown in both the open and closed positions. A similar die is used for shaving.

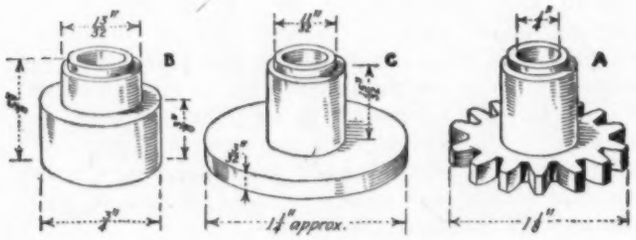


Fig. 1—Steps in making a gear by press tools

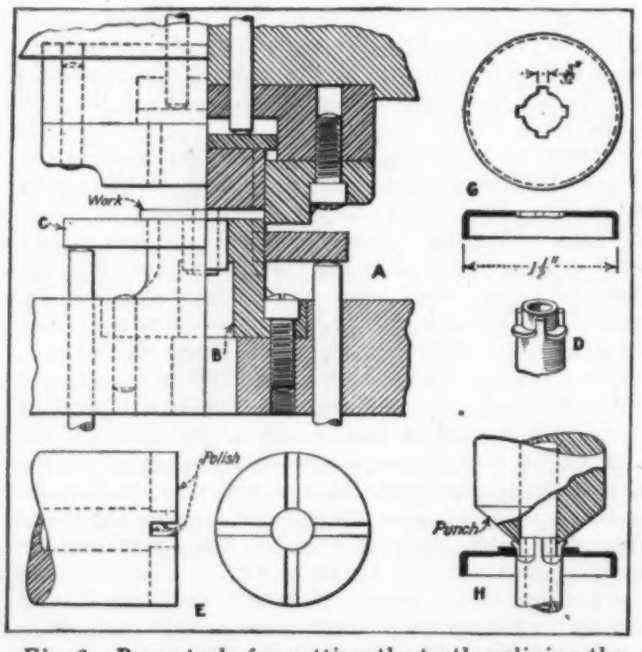


Fig. 2—Press tools for cutting the teeth, splining the hub and for assembly

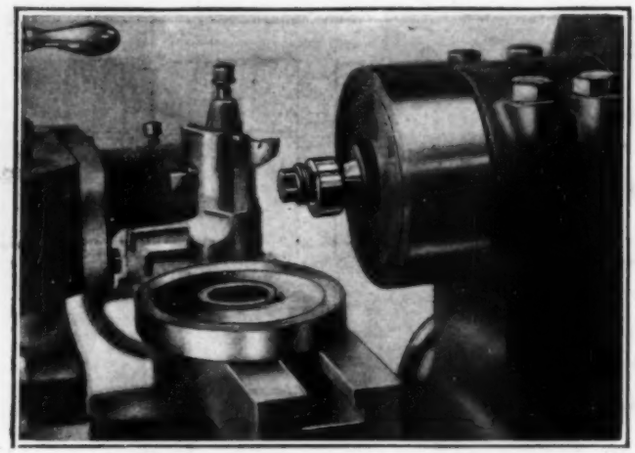
A sheet-metal part is assembled to the hub of the gear, and formerly three screws were used to locate it in place. With slight changes in the design of the parts, the assembly now is handled by press tools. The hub is splined as shown at *D* by the punch *E*. Swaging dies for work of this kind most be polished on their contacting surfaces. Grinding will not suffice. The metal swaged or cut from the hub forms a seat for the location of the wheel. At *G* is the part having a splined hole in it to correspond with the form of the hub. A washer, also having a splined hole, is placed over the hub of the wheel at assembly to give greater rigidity. The final operation ring stakes the four splines as shown at *H*. Loosening or turning of the part is practically impossible since a tight, solid assembly is maintained. The method eliminates drilling and tapping, and the tedious task of inserting and tightening small screws. The added press operations are manipulated more easily and make possible a better product.

Arbor for Turning and Facing Gear Blanks

By E. V. Allen

There are many schemes in use for holding gear blanks for turning and facing one side, after they have been bored and faced while chucked in a lathe or screw machine. An ordinary mandrel is often used where only a few blanks are to be machined, but it has the disadvantage that it is difficult to properly finish facing the hub without cutting into the mandrel itself. Then too, unless considerable care is taken with short-hub gears, the work is apt to cock over out of true, or to slip during the turning of the periphery.

The expanding arbor shown has proved very satisfactory where the diameter of the gear blanks is not so great as to cause a tendency to slip while turning the outside. The arbor consists of a tapered plug set into the regular chuck holder on the end of the machine spindle. A hardened split ring fits over the taper plug, and is expanded in the bore of the gear blank being forced onto the taper by means of a shouldered cap-screw. The shoulder on the arbor is set out far enough from the end of the spindle to allow the turning tool to clear on gears smaller than the spindle end. The



Expansion arbor for holding gear blanks

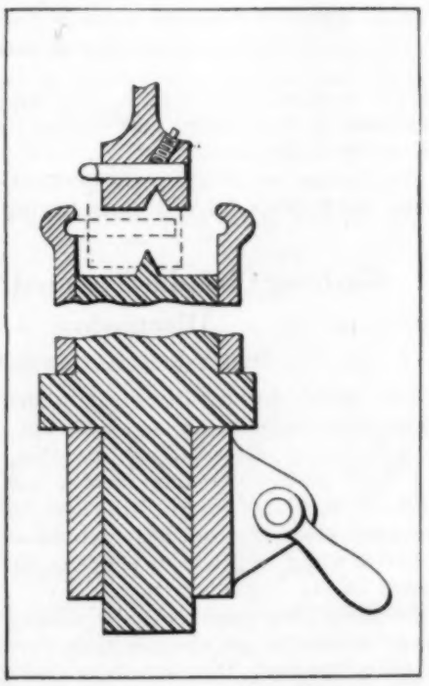
face of this shoulder acts as a stop for the turned end of the gear hub, the action of the expanding ring as it is tightened tending to force the gear hub back solidly against the face of the shoulder. The split ring is made narrower than the length of the gear hub, so that the facing tool can feed past the edge of the bore and leave a clean cut.

A Simple Method of Grooving Sleeves

By Dexter W. Allis

A quantity of 1½-in. die-cast sleeves required on the inside of each a concentric groove. The grooves were for clearance and, therefore, not being precision work, the job was done on the drill press.

The circular table was removed, and in its place was inserted a cylindrical, cone-tipped piece having its upper portion a sliding fit in the interior of the sleeves. As shown in the sketch, the drill-chuck carried a flexible-stemmed cutter-holder having a round-nosed cutter secured at the lower end by means of a set-screw. In the bottom face of the holder was formed a conical depression, so positioned as to be ⅛ in. off center in a direction away from the cutter point. In the operation of the device, a sleeve was slipped over the upright fixed piece, and held firmly. Next, the rotating cutter-holder was brought down until the offset conical hole engaged the upright point. This threw the flexibly mounted holder off center in its rotation, and forced the cutter point to run in a larger-diameter circle, and so cut into the inner wall of the sleeve. For this job, the flexible stem of the holder was ¼ in. in diameter and 7 in. in length.

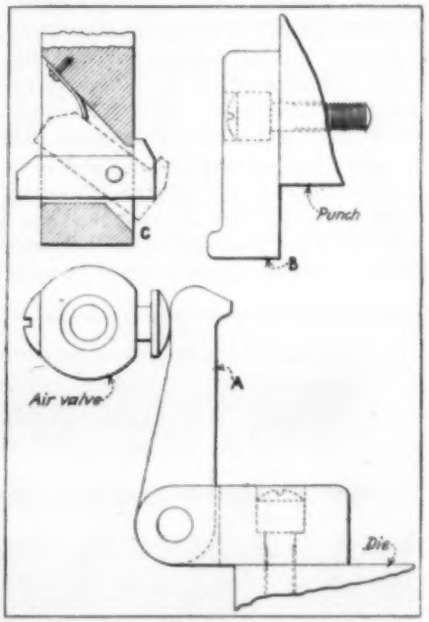


Tool for grooving sleeves

Air Blast for the Punch Press—Discussion

By Frank Waldo

The device shown in an article under the title given above by Alex. A. Curtis, and published on page 28, Vol. 65, of the *American Machinist*, is a handy appliance for press work, but the automatic attachment described seems somewhat complicated. I use the same principle, employing the arrangement shown in the illustration. The lever *A* is pivoted to the die shoe. Its upper end bears against the air valve so that the spring pressure of the operating button holds it to the right as far as it will go. On the ram is mounted the trip *B*, so located that it will press the lever against the operating button of the air valve when the ram is lowered. If operation of the valve is desired only on the upward stroke, the arrangement as shown at *C* can be used. The flat spring should have a light tension so that the trip will not operate the valve on the downward stroke.



Air ejector for press work

Rolling Sheet Metal Tubes of Oval Section

By John Strama

The set of rolls shown by Fig. 1 were designed by the writer to produce the oval tubes to be seen in Fig. 2, by the rolling process. The latter illustration shows two different sizes of tubes, for which two sets of rolls were provided. The stock of which the tubes are made is sheet steel of 0.038 in. thickness. The individual tubes were produced in 120-in. lengths.

There are four pairs of rolls of the top-and-bottom type, represented at *A*, *B*, *C* and *E* in Fig. 1, and one pair of side rolls as at *D* in the same illustration. The construction of the mill, rather than any requirement of the process, necessitated the use of the side rolls, since the operation at that stage could as well be performed by the same type of roll as is used for the other stages. The mill had provision for but four pair of horizontally disposed rolls, and was fitted with a side rolling attachment.

In a mill of this kind the rolls of the first pair are usually plain cylinders and are depended upon only to

feed the stock to the train. In this case, however, the first pair starts forming the metal immediately. The lower roll is flanged, the flanges acting as guides for the entering metal and also serving to keep the upper roll in alignment. The angles of the mating rolls are made to diverge slightly at *X X* for the purpose of relieving unnecessary pressure upon the upturned edges of the stock and concentrating it at the bend. The second set of rolls forms the strip of metal into a U-shape, as indicated at *B*, while the third set, *C*, starts closing in the rounded sides. The side rolls *D* revolve upon vertical studs that are adjustable horizontally to and from the center by independent screws. These rolls are not flanged. The fifth pair of rolls completes the operation by squeezing the tube into its final shape. All of the horizontal rolls are gear driven. The top roll in each case has a vertical adjustment while the position of the bottom roll is fixed. The side rolls are driven only by the stock passing through.

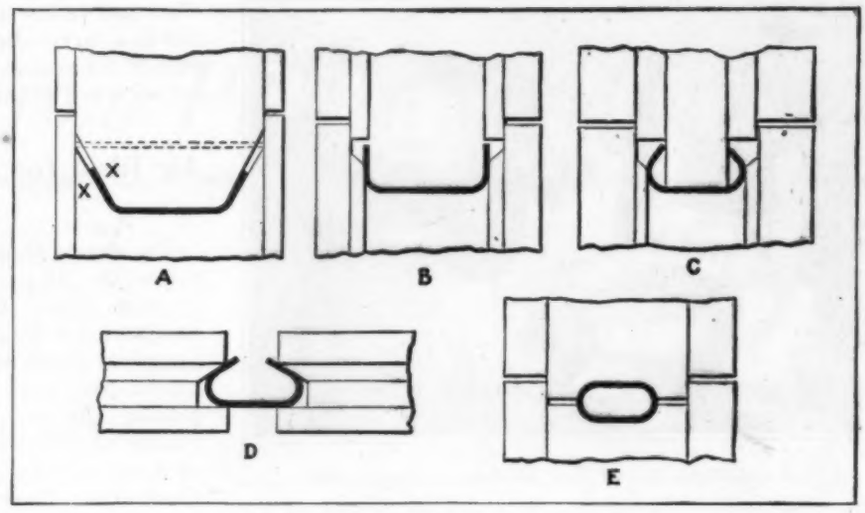


Fig. 1—A set of tube-forming rolls

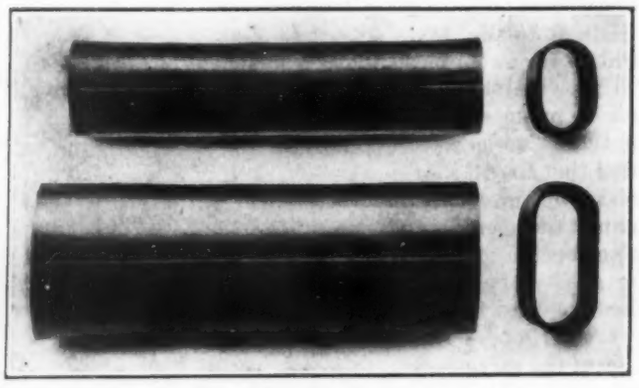


Fig. 2—Tubes formed by the rolls

The space between each pair of rolls and the next successive pair is bridged by a guide that supports the partly formed tube from pass to pass.

Taps for Spring Threading Dies

By CHARLES H. GEORGE

While in charge of the toolroom of a large manufacturing establishment I was required to get out quantities of spring threading dies for the screw machine department. The dies in use were not doing good work and it was up to me to find the trouble and remedy it.

In threading the dies, four taps (inherited from my predecessor) were used. The taps increased slightly in size, successively, the final tap being 0.005 in. oversize. The dies were tapped before the gashing had been done. The action of the die so made, when closed to size by the adjusting collar, is shown exaggerated in Fig. 1. It will be seen that the contact with the work is in the center of the lands, and not at the edges. Such a die will do more mashing than cutting.

Discarding the oversize tap, I made a tap 0.005 in. undersize and tapped the dies after they had been gashed, and when they were closed in by the adjusting collar, all burrs having been removed. The tap was run through several times, adjusting the collar a little each time until the die had been closed in from 0.007 to 0.010 in. The result, after the die was adjusted to size, is shown exaggerated in Fig. 2. The lands have abundant clearance in the center and the cutting edges are in contact with the work.

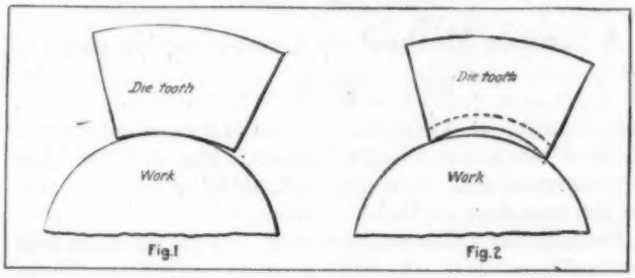


Fig. 1—Effect of using an oversize tap. Fig. 2—Effect where proper tap is used

No further trouble was experienced with the dies so made, the threads cut with them having a smooth finish.

Gashing Circular Formed Tools—Discussion

BY DAVID G. KALLSTROM

The article by H. B. Schell, under the title given above, and published on page 843, Vol. 65, of the *American Machinist*, attracted my attention.

I have gashed circular formed tools by all known methods, and have obtained the best results by grinding the gash after the tool has been hardened. I used an abrasive wheel of the same shape as the gash in the tool shown in Mr. Schell's article.

Grinding the gash saves a milling operation, and abrasive wheels are cheaper than formed cutters. By grinding the gash, the chances of cracking in hardening are greatly lessened.

Production and inspection are entirely different functions. They should be carried on by different personnel. In the small shop, where that is impossible, each of the two functions must be approached with an appropriate attitude of mind.

Characteristics of Cadmium Plating

Cadmium plating is employed primarily for rust-proofing iron and steel in almost any place where zinc has been used for this purpose. While zinc is applied by several different processes, that is, by electro-deposition, hot dipping, spraying, or sherardizing, the application of cadmium is almost entirely by electro-deposition. Cadmium can now be deposited on steel to form a dense, ductile, and bright plate, which is claimed to offer a greater degree of rust resistance than a heavier coat of zinc. Cadmium is therefore finding a place as an efficient metal coating.

Cadmium belongs to the same group of metals as zinc, but it is a silvery-white crystalline metal like tin, and like tin has the peculiar property of giving out a crackling sound when bent. It has a brilliant luster when polished. It is ductile and can be rolled into thin sheets or formed into wire. Cadmium is less soluble in most acids than zinc, while strong alkalies have little or no action on it, although they dissolve zinc rapidly. On account of its oxidation resistant properties cadmium is a better rust-proofing coating than zinc.

The specific gravity of cadmium is 8.604, as compared with a specific gravity of 7.142 for zinc. It is therefore somewhat heavier than zinc. It has a tensile strength of 13,660, which is lower than that of zinc, and its average hardness is about 15 per cent less than that of zinc. It can be rolled readily into sheets, or beaten into thin foil. The melting point of cadmium is 608 deg. F.

When zinc is in contact with weak salt solutions basic salts are often formed. These salts are not adherent, and do not form a protective coating. But with cadmium under the same conditions a sub-oxide is formed, which gives a continuous adherent film and forms a protective layer. This property of cadmium is valuable for plated parts subject to exposure to salt solutions in commercial work.

Since cadmium is softer than zinc, it is sometimes not as desirable as a plating material where the parts are exposed to mechanical wear. But on the other hand its ductility makes it preferable to zinc as a coating where the parts are exposed to knocks or blows. For this reason a thinner plate of cadmium can be used than for zinc.

For plating iron or steel with cadmium the parts must be cleaned thoroughly to insure a dense, ductile and bright plate free from irregularities. These properties are so intimately connected that under most conditions the other qualities are satisfactory when a bright plate is produced.

The chief ingredients of the plating solution are cadmium hydrate and ammonium sulphate in a solution of sodium cyanide and caustic soda. Anodes of cadmium are used. The maximum current densities employed are between 60 and 70 amperes per sq.ft. The solution is operated at normal temperatures, or up to a temperature of about 130 deg. F. It is not necessary to agitate the solution, although with mechanical agitation of the bath the current density of the cathode can be increased.

The plating solution is stable under normal conditions of operation, and it has rarely been found necessary to add any of the ingredients to the solution other than the water lost by evaporation. The amount of cadmium lost by the anodes in use is equal to that deposited on the material plated. The rate of deposit of cadmium is about 0.0001 in. per amp.-hr. per sq.ft., which is nearly 40 per cent faster than the electro-deposition of zinc.

Cadmium costs several times as much as zinc, and for that reason cadmium plating does not compete directly with zinc. Cadmium is finding a definite place in the field of rust-proofing in co-ordination with zinc. Its color and brightness calls for its use where appearance is demanded, and its greater ductility makes it valuable as a rust protection for material that must be bent or twisted in fabrication or use. Its resistance to the action of alkalies as well as acids also offers opportunities for its employment.

The rapidity with which cadmium plating can be done, and the short time required to secure a high degree of rust resistance, enables large production on quantity work. This consequent reduced labor cost, as well as the low maintenance cost due to the stability of the solution, often more than compensates for the high cost of the cadmium metal.

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Sawing Glass Plates

Q. In our product we require a block of glass ½ in. square in cross section by 3 in. long. Is it feasible to cut these pieces from ½-in. plate glass? All four side surfaces must be smooth. We require the pieces in considerable quantities.

A. It is possible to saw the pieces out of plate glass, but for any ordinary usage we do not believe that it would be advisable. Any glass factory can supply such pieces molded to form, and if necessary would probably grind the sides cheaper than you could saw them.

For occasional glass cutting, however, a brass disk can be used, rotated on the arbor of a milling machine. A disk 4 or 5 in. in diameter and ⅛ in. thick will do for average plate glass. Diamond dust and oil makes the best cutting mixture for the disk, but any coarse hard abrasive can be used with water. The glass to be sawed should be clamped above the machine table so that the disk will dip into a pan containing the thick abrasive mixture, and feed it up through the cut. Cutting in this way, however, is a slow process.

Plating Die Castings

Q. How is nickel plating done on zinc-base die-casting metals? Can it be applied successfully?

A. We believe that these casting metals offer no greater difficulty than the ordinary lead alloy casting metals. Give the parts a coat of copper plate first if the percentage of lead in the alloy is high, or if there is little or no copper in the alloy. If this does not give satisfactory results your trouble is probably with your solution or with the current, and an expert plater should be called in.

Machining Magnesium Alloys

Q. Can you give us any information on the machining of magnesium castings? Would you recommend this metal to replace aluminum parts?

A. By magnesium we presume that you refer to the magnesium-aluminum alloys, since magnesium alone does not make a satisfactory casting for commercial parts. For the machining of these alloys it is advisable to use carbon steel tools as for brass, and the marks of the grinding wheel should be removed with a fine oil stone.

For average turning a round nose tool will give good results. The side slope should be from 12 to 15 deg., and a clearance of about 12 deg. is advised. Cutting speeds up to 200 ft. per min. are recommended. Deep cuts with coarse feed can be obtained, but fine feeds are recommended for finishing cuts.

Carbon steel twist drills and standard taps are used for the magnesium alloys. Drills can be run at 150 ft. per min. Heavy feeds are used in drilling. Magnesium alloys are in general easily machined, and the tool characteristics are very similar to those for machining brass, though higher speeds can be expected on these alloys.

The second question is too general to answer intelligently in a short space. The magnesium alloys are used where lightness is desired, since a 92-per cent magnesium, 8-per cent aluminum alloy is only about 70 per cent of the weight of commercial aluminum. But there are some disadvantages to the magnesium alloys that should be investigated from the standpoint of the parts in which you desire to use the metal. The alloys are corroded easily under some conditions, though they resist alkalis and hydrofluoric acid. The magnesium alloys have found their greatest value in aircraft manufacture, and for automobile engine parts.

Answering Practical Inquiries

Q. I am a subscriber and may need your help occasionally with problems I run up against. Will you please tell me the extent of this service, and what kind of questions we may ask?

A. We try to answer any questions for our readers. You can obtain a good idea of the nature of these questions by glancing over the "Practical Shop Problems" in any issue of the *American Machinist*.

The printed questions and answers, however, form only a small percentage of the problems of all kinds sent to us by our subscribers and advertisers. We have the practice of printing only such problems as we consider of general interest. All questions are answered by mail, whether or not they are printed. This is a part of the service offered by the company.

We assume, however, that our clients will put up to us only those things that constitute to them real problems, making all reasonable efforts first to solve the matter themselves. Merely attempting to save time by putting up to us the difficult things would naturally burden our time to such an extent that it would be impossible for us to handle the inquiries. We do not divulge the name or address of a correspondent without his consent, but endeavor to forward any correspondence to him.

Bluing Steel Parts

Q. Will you please advise me of the process whereby small steel parts are blued?

A. On pages 610 and 993, Vol. 64, of the *American Machinist*, we published two methods of bluing steel parts. Another method of obtaining a blue-black, that has been handed to us since then, is as follows: Apply a concentrated solution of nitrate of copper when the steel articles are slightly heated. The shade may be varied from blue-black to brown-black by adding nitrate of manganese to the solution.

Technical Abstracts

Management's Share in Waste Elimination

Since the Hoover Committee's report charging management with the largest share of responsibility for waste in industry, management has set its house in order and has accumulated abundant evidence of aggressive war on waste. Today management takes money from the investor and pays it to the laborer, who in many cases is the same individual. On this trip around Robin Hood's barn, however, management succeeds in making a salable product. There is a difference of opinion as to whether management, capital or labor really controls the destinies of busines. The choice depends on the affiliation of the one expressing the opinion.

Much has been done by management in solving the problems connected with labor policies. Employment methods have been greatly improved and spoiled work has been reduced. Foreman training and the stimulation of "interest in the job" are now receiving careful attention. Organization and coordination have not had the study they deserve and therefore represent the next points of attack. If job analysis is good for the wage earner it is better for the man on salary.

Today the success or failure of the enterprise rests upon the shoulders of management which must see to it that its organization is a unit. When this has been accomplished the other problems are easier of solution.—R. W. Sparks, in *The Management Review*, December, 1926, p. 359.

Wage System in German Steel Industry

Nearly all wage earners in the metal industries of Germany are members of labor organizations, and practically all of the work done by them is covered by agreement between employers and the unions. The German organization of metal workers covers the workers in all industries from blast furnaces to remanufacture in machine shops, and even work in precious metals.

The whole system of wage rates in Germany is very puzzling to an American. Thus, in the Bochum district all iron and steel workers are divided into six main groups: Unskilled and transport workers, semi-skilled workers, semi-skilled trained workers, skilled trained workers, better skilled trained workers, and special skilled trained workers. This collective grouping of wage earners seems to be the outgrowth of the new labor conditions that have arisen in Germany since the war.

Within the group the average rate is determined by the age of the worker without regard to his ability. When the employee has a wife he is paid one pfennig more per hour, and two pfennigs more per hour for each child under 14. Married men are protected by law against dismissal because of this additional wage. From the wages of the workers, deductions are made to cover taxes, and sickness, old age, accident and unemployment insurance. Taxes take from 5 to 10 per cent of the wages, depending on the income and the family dependent on the worker.—*Monthly Labor Review*, Nov. 1926, p. 112.

Strength of Single-V Welds

Tests extending over a period of six years have just been completed by Union Carbide and Carbon Research Laboratories on single-V joints in firebox quality plates welded by oxy-acetylene. These test plates were welded at intervals by operators employed in abouty eight railroad shops scattered throughout the country. About 500 specimens were tested in tension after the welded portion had been ground flush with the plate. The results indicated that with a first-class low-carbon steel welding rod, eleven per cent of the specimen failed in the plate, the average ultimate strength of which was 53,000 lb. per sq.in.; with a "high-test" rod, containing 0.20 per cent carbon and high in manganese and silicon, nearly half the specimen broke in the plate rather than in the weld. In the last case, the variation in ultimate strength between the best and the poorest weld was not much greater than the corresponding figures for the plate.

By means of a probability curve, it is estimated that the expected strength of a single-V weld made by operators selected with reasonable care is 47,000 lb. per sq.in. with a low-carbon steel welding rod and 58,000 lb. per sq.in. with a "high-test" rod. In selecting a factor of safety, the elastic limit of the base metal should be the ruling consideration. — *Oxy-Acetylene Tips*, November, 1926, p. 61.

Structural Features of the Steam Turbine Rotor

Increases in power from 500 to 60,000 kw. and in steam pressure from 150 to 1,200 lb. per sq.in. have revolutionized methods of turbine rotor manufacture. Liberal safety factors are applied to working stresses based on the elastic limit of the material instead of on its ultimate strength and all material is inspected and tested before use. All large castings are annealed and heat-treated to obtain the proper molecular structure and to remove internal strains. Shaft forgings are bored axially and inspected by mirror and telescope for bore flaws. To check the thoroughness of the anneal the forging is heated slowly and uniformly and allowed to cool. It is then inspected for warping, a very small change in alignment being sufficient to cause rejection.

The built up cast steel assemblies and later individual castings have been superseded by quenched and tempered carbon steel and nickel steel forgings with elastic limits of not less than 50,000 and 65,000 lb. per sq.in., respectively. After finish machining the wheels are subjected to a kerosene and whiting test for surface cracks and a magnetic test for hidden flaws in the structure.

The more accurate machining made possible by modern equipment has permitted better joints where blades join the wheel, and also the dynamic balancing of the whole rotor.—J. M. Downer, in the *General Electric Review*, December, 1926, p. 829.

Why the Machine Tool User Needs Service

Years ago, a machine tool manufacturer, after he had sold a machine, heard nothing more about it. It went into a plant where it was used by mechanics of practically the same degree of skill as those who had been engaged to build it.

Today, conditions have changed, and with the new conditions has come the demand for service. The machines are more complicated, and when they are placed in the large modern production plants they are no longer handled by all-round skilled mechanics. If something goes wrong, the men who operate them are seldom able to repair the damage—and, unfortunately, things go wrong much oftener than in the past because the unskilled operator has no appreciation of the skill required by so complicated a mechanism as an automatic or semi-automatic machine of modern design.

This is one of the main reasons for the demand for service in the machine tool field. While considered excessive by many, it is not likely that the demand for service will ever become less. On the contrary, it is likely that the machine tool builder's plant will be called upon to furnish more and more of the skill required to keep the equipment in use today in operating condition.

Recognizing this tendency of the times, the progressive machine tool builder so organizes his business that he is in position to render this service. What is needed is some systematic method of charging for it; because, unless the price of the machine is high enough in the first place to cover it, it must of necessity be charged for separately. — *Machinery*, December, 1926, p. 246.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

Standardizing Motor Frames for Mounting

MOTOR drives are increasing in popularity every year and builders of machines are experiencing more and more difficulty owing to the lack of any standardization as to motor shafts, diameter, shaft height and bolt hole centers.

It is, therefore, very gratifying to learn that steps are being inaugurated through the American Engineering Standards Committee for a study of the whole situation with a view to standardizing such dimensions as affect the user in adapting electric motors to his needs. It is also interesting to find that the movement was inaugurated by the builders of machine tools who have become so convinced of the advantages of standardization that they are making a real advance in that direction. The next few years promise much from this field.

Standardization will come more easily if it can be made clear that adopting a standard does not prevent such changes as may seem advisable to the majority, from time to time. It is far better to change standards as frequently as necessary than not to have them at all.

Increasing the Speed of Seeing

THE percentage of time during which close vision is required to perform work satisfactorily varies with the type of operation, but it is usually large. In a study of a score of operations common to industries in which machine tools are used, it was found that close vision was required for an average of seventy per cent of the total time.

Obviously, any improvement that makes for faster seeing without interfering with other important factors such as accuracy of work and the comfort of the worker, increases the productiveness of the worker and of the plant. Increasing the intensity of illumination has been found to do this at a cost equal to only a fraction of the value of the increase in production. Both laboratory and factory tests have proved this beyond any question. It takes time to see an object and the time is very closely associated with the intensity of illumination. Fortunately this expedient not only makes vision quicker but also easier, safer and more accurate. Vision is too generally accepted with little or no realization that its efficiency is just as controllable as any of the other major factors that influence the productiveness of the worker and, consequently, of the shop.

Bonus or Penalty?

SHALL we reward or penalize to secure results? Is it better to give a bonus for work well done or deduct a fine when it is not?

Strict disciplinarians would probably favor the fine on the theory that the men were paid for good work and should not be coddled for doing their plain duty. Theoretically this is probably true but as we are more interested in securing good work and in reducing scrap than in academic considerations, it may be well to consider the other side.

Whether we like it or not, the days of iron discipline have passed. Fining also runs into legal enganglement in some states. And as men are for the most part "boys grown tall," the idea of a bonus—of something extra—has a stimulating effect in many cases.

It is quite possible, however, that it may be better to apply the bonus to quality rather than quantity of work, as it frequently happens that this is the more important. When it comes to assembling machines it is of greater value to have parts for a hundred machines go together than to have twice this number of parts that cannot be assembled.

A bonus to the men with the fewest rejections by the inspector may be a good investment.

Industrial Training and the Trades Union

IN A paper prepared for the annual meeting of the American Society of Mechanical Engineers, Matthew Woll, vice-president of the American Federation of Labor, sets forth a number of ideas that may be all very well as ideals but are anything but practical realities. The idea that it is wise for a union to be the judge of craftsmanship and that skill is a prerequisite to admission to the union is not in accord with experience. Other statements of a similar nature are wide open to attack as will be evident from the two discussions of Mr. Woll's paper that were read at the meeting and are reprinted on another page of this issue. If you read the abstract of Mr. Woll's paper you will be interested in the comments on it.

The publication in the "American Machinist" of an address prepared for the annual meeting of a national engineering society does not imply that the editors agree with the statements made by the author. As a matter of fact the "American Machinist" disagrees with many of the statements made in this particular paper.

Shop Equipment News

Putnam 90-In. Journal-Turning, Quartering, and Pin-Turning Machine

The Putnam Machine Division, Manning, Maxwell & Moore, Fitchburg, Mass., is manufacturing a multi-purpose machine for use in railroad shops. While it is in no sense a driving wheel lathe its capacity is such as to swing an assembled pair of 90-in. drivers for the purpose of turning the journals of the axle, facing the hub-liners, boring the crank-pin holes, and turning the crank-pins in place. Fig. 1 shows a front view of the machine without the attachments.

The construction of the machine is much like that of a driving wheel lathe except that the tail spindle does not revolve and therefore has no drive plate. The position of the toolblock is fixed, and both headstock and footstock are adjustable along the bed. At each end of and inside the bed a 5-hp. reversing motor drives through reducing gears to traversing screws for moving these heavy parts. By means of a friction clutch in the drive, controlled by levers at the operating position, the operator is enabled to make the adjustments without undue effort.

The headstock and footstock are clamped (independently) to the bed by four T-head bolts, which are fitted with a clamping device to draw all four bolts at once and thus impose equal strain on each. The compensating devices consist of bronze wedges drawn together by right- and left-hand screws that are geared to a common shaft and operated by means of a single ratchet wrench from either the front or the back of the machine.

The main spindle is driven by belt from a 15-hp. constant-speed a.c. motor to the first shaft of a four-speed selective gear drive, which is equipped with friction clutch and brake. The gear shift levers are at the front of the headstock, while of the two starting and stopping levers, one is located at the operating position and the other beside the gear-shift lever for use when changing gears. Power is transmitted from the gear box to the spindle through a bronze wormwheel and a steel worm; the latter is hardened and ground and runs in oil. The worm shaft is carried on ball bearings and a ball thrust bearing sustains the endwise load. All gears are inclosed. An adjustable speed d.c. motor of a special type may be used as an alternative drive, in which case the belt and gear box are eliminated and the armature shaft is coupled directly to the worm shaft.

Both live and tail centers are adjustable independently of the stocks by means of the usual screws and handwheels. The live center rotates with the spindle, while in the tail spindle there is a center mounted upon roller bearings and provided with a ball thrust bearing so that it turns with and is driven by the work.

The main drive plate has a 1,000-lb. counterweight opposite to the pin-hole, and two movable counterweights weighing 500 lb. each at the periphery. The movable weights, which can be seen at *A* and *B*, Fig. 2, are gibbed to slide in a circular guideway that is recessed into the face of the drive plate, and they may be secured in any angular position by means of their clamping bolts. To facilitate the adjustment

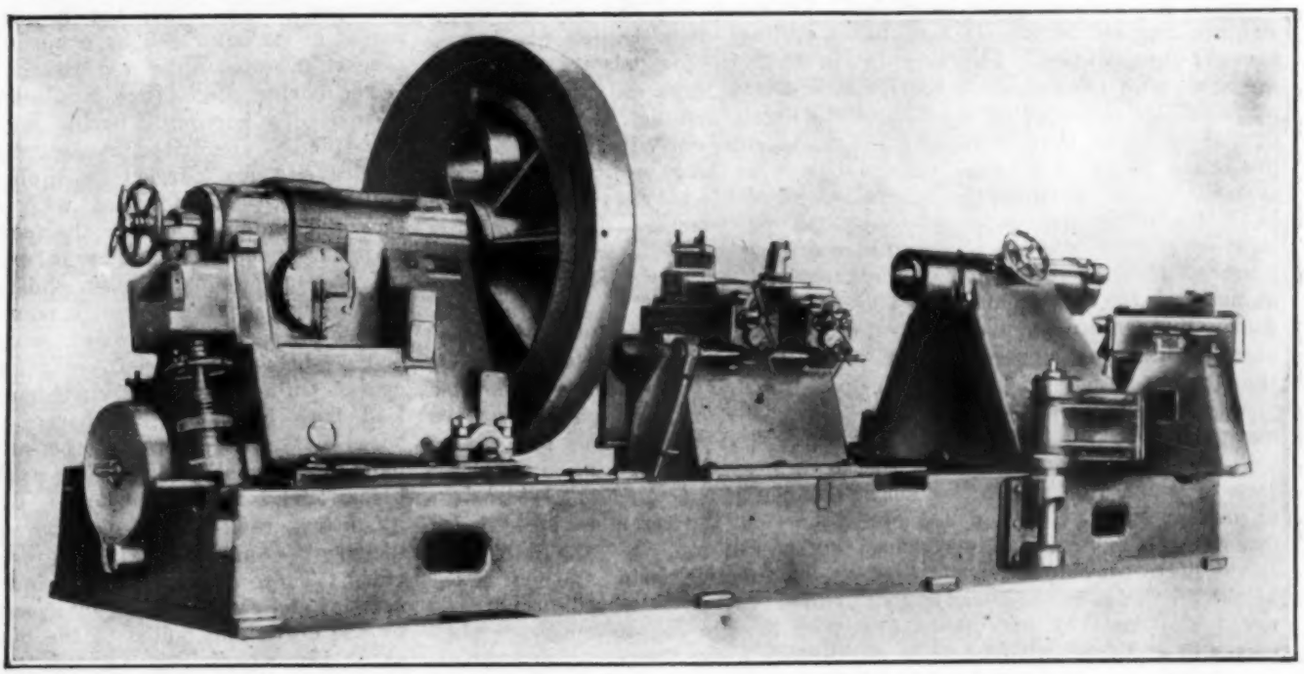

Fig. 1—Putnam Journal-Turning and Quartering Machine

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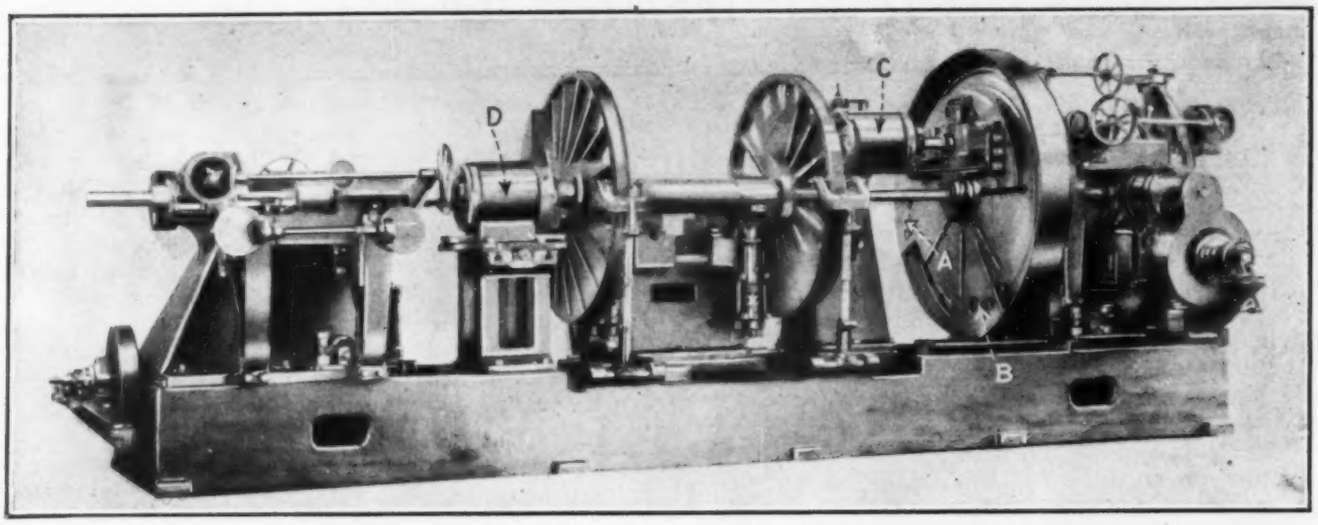

Fig. 2—The machine set up to turn crank-pins in place

each weight is provided with a pinion to mesh with a ring gear at the bottom of the guideway, and the end of the pinion is squared to take a ratchet or other wrench. To prevent accidental movement of the weights when the clamping bolts are loosened for adjustment, a pawl engages the ring gear and must be withdrawn by hand before the weight can be moved.

When both movable weights are diametrically opposite to the fixed weight built into the back of the drive plate, the rotating parts of the machine are in balance. By circumferential adjustment of the movable weights, any set of wheels may be brought into balance. The weights are flush with the face of the drive plate and are shrouded by the flange of the latter so that there are no projecting parts to involve the operator in danger when the machine is in motion. When the counterweights have once been adjusted to balance a set of wheels, suitable marks can be made on the drive plate that will enable the operator to balance that particular set for subsequent operations before he puts it on centers by merely adjusting the weights to the marks.

A two-jawed clamping device, the jaws of which are faced with copper to prevent marring the finished surface of a pin, is permanently attached to the drive plate to drive the work by the crank-pin in the wheel at that end. The jaws of the device are moved to and from the centerline of the pin-hole by a right-and left-hand screw, operated from either end by means of a standard socket wrench.

The toolblock base carries two independent slide-rests which have movements parallel and at a right angle to the centerline of the machine. Power feeds are applicable in all directions. This arrangement enables the operator to carry on the work of facing or turning at one end of the axle without reference to the operation in progress at the other. The feed movement is derived from the rear end of the main spindle through a gear box in which sliding gears provide three changes of feed.

To accomplish the corresponding operations upon trailer wheel sets, in which the journals are outside the wheels, a separate toolblock and slide-rest, having the same feed movements derived from the same source as the regular rests, are provided. This block is pivoted to the base of the machine and may readily be swung out of the way to bring the footstock forward. Fig. 1 shows it in this position.

As trailer wheels have no crank-pins the jaws of the clamping device on the drive plate have removable extensions long enough to grip the wheel by a spoke. Only one end of a set of trailer wheels may be handled at one setting; to get at the other end the set must be reversed on the centers.

To function as a quartering machine, the main spindle is locked with the pin-hole in the drive plate directly above the center, and two attachments are provided. One of the quartering attachments is mounted above the headstock and the other back of the footstock. These attachments do not have to be disturbed to use the machine as a lathe.

The radial distance from the centerline of the machine to that of the quartering bar is adjustable vertically in the case of the one on the headstock and horizontally in the other by means of handwheels and screws. The range of adjustment is from 22- to 36-in. stroke.

The bar at the headstock end projects through the pin-hole in the drive plate and is supported close to the cut by a bushing attached to that plate. The other bar is supported at its outer end by a bushed bracket mounted upon a pedestal.

The boring mechanism is similar to that of a horizontal boring mill. The spindles are driven by separate motors and are carried in sliding quills, which are provided with a rack and pinion to actuate the feed. Two power feeds, $\frac{1}{32}$ and $\frac{1}{16}$ in. per rev., are obtainable through sliding gears. The driving power is transmitted to the spindle through worm and wormwheel speed reducing gears. On a wheel set of right-hand lead both holes may be bored at once; if the lead happens to be left-hand it is necessary to reset the work before boring the second hole.

To turn crank-pins in place the attachments *C* and *D*, Fig. 2, are provided. These attachments are independent and can be swung into place by the crane and bolted to the machine bed when their services are required. Each consists of a pedestal to support a cylindrical

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bracket in which revolves a sleeve.

On the outer end of each sleeve provision is made to accommodate two turning tools with radial adjustments for turning different diameters. The inner end of each sleeve is attached to the quartering bar, from which it derives both its rotative and its feed movements.

The wheel set is first placed on centers and the adjustable V-block jacks, which are permanently at-

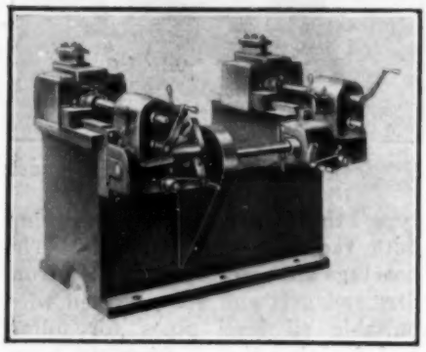


Fig. 3—Toolblock to machine main axles of three-cylinder locomotives

tached to the base of the toolblock, are brought up under the journals to take the weight. Clamps are provided to secure the journals in the Vs, after which the centers are withdrawn by means of their screws.

To insure against movement of the wheels while the operation is being performed, swinging clamps are brought up into position, as shown in the illustration, and made to grip the rims of the wheels by means of opposed and pointed setscrews. Both pins of a set of wheels of right-hand lead may be finished simultaneously, but for those of left-hand lead a resetting is necessary.

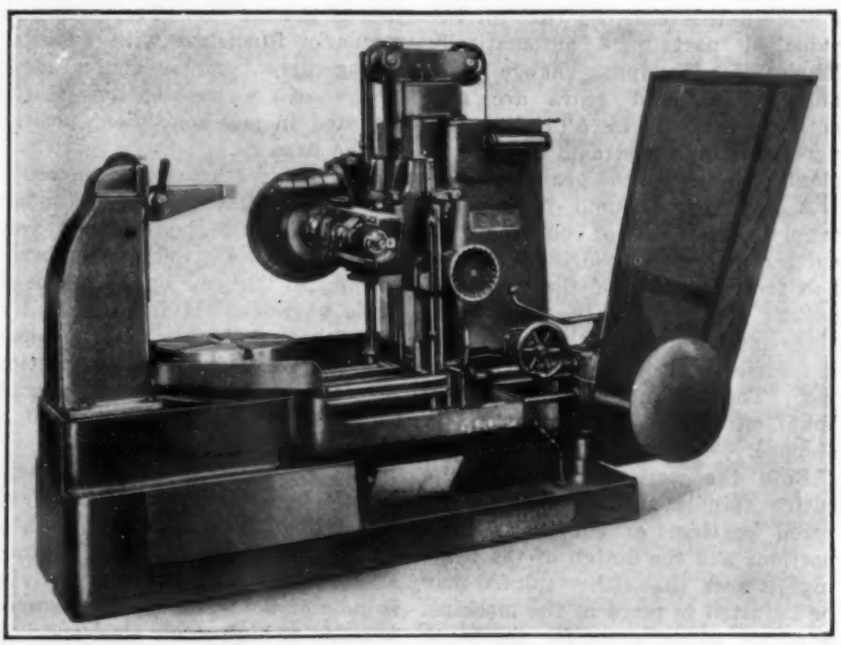
Plans are under way to provide circumferential adjustment for one or other of the quartering attachments in order to adapt this machine to the lead angles encountered with three-cylinder locomotives. The three cylinder locomotive has a double crank-web and pin midway of its main axle, making necessary two additional journals to be redressed when occasion arises. To accommodate this type of axle, the machine under discussion is provided with a separate toolblock, shown in Fig. 3, to replace the regular block. This block has two slide-rests with longitudinal and cross feeds to turn the short journals and face the hubs.

Gould & Eberhardt No. 36-HS Manufacturing Hobber

A larger size manufacturing hobbing machine, shown in the accompanying illustration, has been brought out by Gould & Eberhardt, Newark, N. J., for generating spur gears and similar work. The construction of this machine, which is designated as the No. 36-HS, is similar to the smaller size No. 16-HS which was described on page 194, Vol. 60, of the *American Machinist*. Hobbing machines for cutting gears on a production basis have heretofore been limited to comparatively small gears. This machine, however, will cut spur gears in steel up to 3 pitch and up to 36 in. in diameter on a production basis, with an ultimate capacity of 42 in. in diameter. The machine is especially adapted for the cutting of transmission gears, such as are used in tractors and trucks, and for gears used in the mining and hoisting industries.

One of the features of this machine is the powerful worm and wormwheel drive to the cutter spindle, which is mounted so that it may be swiveled through 0 to 15 deg. to accommodate single-, double-, or triple-thread hobs for both roughing and finishing operations. The indexing wormwheel is made of semi-steel and is of a coarse pitch, 24 in. in diameter. It is driven with a hardened and ground worm. The gear train is of the balanced type; that is, the same number of gears are used to drive the cutter spindle and the work spindle. This construction is said to result in a uniformity of rotation between the cutter and the gear blanks, so that accurate gears are produced.

As in previous machines, the blanks are mounted upon a vertical spindle and the feed of the hob is down. With this substantial type of support, feeds and speeds that are comparable with those that are now being obtained on smaller gears are possible up to the full capacity of this machine. The cutter carriage is arranged with power traverse of 100 in. per min. in either direction and may be operated either with the work and cutter spindles rotating or idle. The rapid-traverse operating lever is interlocked with the feed lever so that neither the feeding nor the power traversing movement to the cutter is started without the other movement being first disconnected. Additional provision is made to prevent accidental operation of the rapid power tra-



Gould & Eberhardt No. 36-HS Manufacturing Hobber

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verse in a downward feed direction.

The rapid power approach brings the hob to the cutting position where it is automatically stopped by means of an adjustable stop cam. The feeds may then be started by the operator tripping the feed lever. The rapid power reverse completes the cutting cycle by returning the cutter carriage to its upper position to permit the rapid unloading and reloading of gears.

The work arbor support accommodates gears up to 24 in. in diameter. A movable arm is mounted on the box type of column and is counterbalanced so that, when the operator elevates it, a locking pin is automatically released so that the arm may be swung out of the way quickly. This facilitates the loading of blanks. The diameter of the work table is 20 in. Stacked gear blanks with an aggregate face of 16 in. can be hobbed at one setting.

The drive of the machine is through a constant-speed pulley mounted on Timken roller bearings, and incorporating a plate-type clutch. The pulley is entirely inclosed with an expanded metal guard. All of the drive parts of the machine have been segregated in a case mounted on the base of the machine at the rear. By means of a positive-driven oil pump a copious supply of lubricant flows into a distributing pan where it falls on all the mechanism in this case, so that all the principal parts are automatically lubricated. The index change gears and cutter speed gears are also entirely inclosed in oil-tight compartments, and a stream of oil constantly flows over the gears.

A centrifugal pump is used to supply a large flow of coolant to the cutter; instead of pouring over the hob from the end of the pipe, the coolant goes through the cutter carriage and is forced on the hob, which is completely flooded without splashing. The coolant is automatically shut off when hob rotation is stopped.

Both the work spindle and the cutter spindle are mounted on tapered bearings of substantial proportions and the design of the bearings is such that either spindle may be adjusted in place in the machine. Separate adjustments for the taper diameter fit and the end fit can be made. A positioning device is also provided so that full advantage can be taken of the full length of the hob; hence it is possible to shift the hob from a dull to a sharp position without taking it from the arbor and inserting spacing collars.

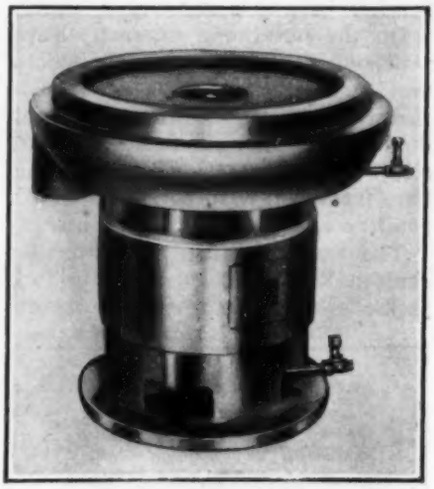
The machine is regularly furnished with a full complement of feed and cutter speed gears and with index gears to cut from 6 to 50 teeth, and from 50 to 150 teeth, excepting the prime numbers or their multiples. The machine can be arranged with automatic infeed attachment for hobbing wormwheels. When it is desired to drive the machine with an electric motor, a bracket is mounted over the gear case at the rear on which the motor can be mounted and connected by means of a silent chain inclosed in a sheet metal guard. A 7½-hp. motor with a speed of 1,200 r.p.m. is recommended.

Gardner No. 88—18-Inch Disk Grinder With Vertical Motor

The No. 88—18-in. disk grinder with vertical motor, was developed by the Gardner Machine Co., Beloit, Wis., to handle numerous grinding operations on flat surfaces of relatively small area, where the ground portion is not required to have an accurate relation to any other portion of the casting. The machine is regularly furnished with an alternating-current motor controlled by means of a push-button station mounted in any convenient position on the base.

The motor frame itself serves as the machine base. In the standard type illustrated the distance from the floor to the grinding member is 22⅝ in., so that the operator can sit while at work. If it is desired to raise the grinder so that the operator can stand during the operation, a special pedestal can be supplied to raise the height of the disk to 33 inches.

A steel disk 18 in. in diameter travels in a horizontal plane. This wheel is supported by a substantial wheel collar mounted on the rotor shaft, which forms the driving spindle of the machine. The spindle is made of high-grade steel and is of ample proportions. It is supported on ball bearings of the deep-groove



Gardner No. 88—18-In. Disk Grinder

type, the lower bearing carrying both radial and thrust loads. The bearings are carefully protected from dirt and grit and are provided with suitable oil level pipes for filling and draining the oil from the bearing housings. The upper bearing is provided with an oil slinger, which keeps a constant stream of oil flowing over the bearing.

A 5-hp. motor rotating at 1,800 r.p.m. is regularly furnished. It is of the squirrel-cage type.

A cast-iron guard ring is fastened to the top of the base. To it may be secured work holders, dressing devices, etc. A dust channel of ample size with a connection for an exhaust pipe is placed around the wheel. Although the machine is not equipped with a water tank, wet grinding can be performed when a separate source of water supply is available.

A rigid horizontal bar dressing device of the type in common use on such machines is supplied. A sliding block carrying dresser cutters is forced back and forth across the abrasive disk by hand, and it is claimed that a well-trued grinding member is thereby assured.

"Steptoe" Shapers

The Western Machine Tool Works, Holland, Mich., has purchased the shaper assets of the John Steptoe Co., Cincinnati, Ohio, and will continue the manufacture of this complete line of Steptoe shapers, ranging in size from 14 to 24 in. The machines can be arranged for cone pulley drive or motor drive.

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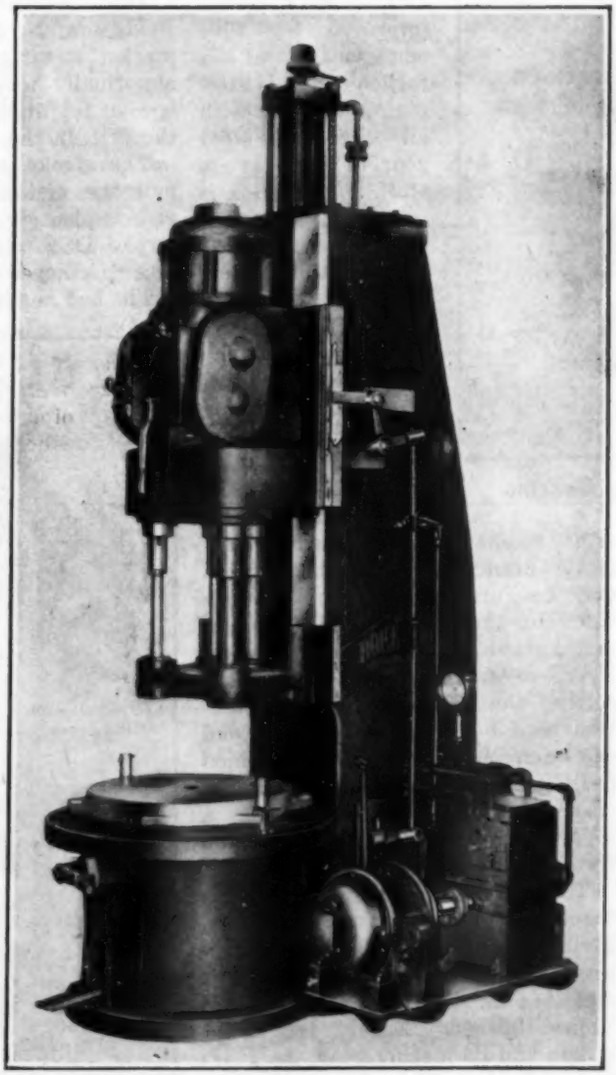
Rockford Vertical Drilling Machine With Oilgear Feed

The Rockford Drilling Machine Co., Rockford, Ill., has put out a vertical drilling and boring machine with Oilgear feed for general purpose production work.

The machine is designed with a vertical motor built integral with the head. The drive is through a worm and wormwheel of special design for obtaining the necessary reduction of motor speed to spindle speed. The head is also arranged with pick-off change gears for obtaining speed changes. The head can also be supplied with one or two speeds obtainable through a hand lever, such as is shown in front of the head in the accompanying illustration. The entire drive is mounted on Timken roller bearings and both gears and bearings run in heavy oil. The drill spindles are mounted in double bronze bushings and are driven through spur gears placed between bearings. Any arrangement or number of spindles can be furnished to suit the particular requirements of the job to be performed. The entire head carrying the drive, as well as the spindle unit, traverses up and down on the ways of the column by means of an Oilgear pump and cylinder. Two types of control are available; either hand control giving feed speeds in either direction, as well as rapid traverse in either direction by means of a directional hand lever; or an automatic control where it is only necessary for the operator to start the cycle. With the automatic control, rapid traverse is obtained in both directions and two different feed speeds can be obtained in a downward direction. As shown in the illustration, the pump is driven by a separate motor.

The table for this machine can be furnished in a number of different styles. It can be of the indexing type, as shown, for either hand or power indexing; it can be of the stationary type, either square or oblong; or it can be of the cross sliding type with either hand or power feed. Various diameters of indexing tables can be furnished.

The machine throughout is of rigid structure and is adaptable to either heavy or light classes of work on a production basis.



Rockford Vertical Drilling Machine with Oilgear Feed

Trent 100-Lb. Electrical Melting Pot

The electrically-heated metal melting pot shown in the accompanying illustration has been added to the line of similar equipment put out by Harold E. Trent Co., 259 North Lawrence St., Philadelphia, Pa. The pot is intended for melting solder, lead, babbit, tin, and similar low melting point metals. Its capacity is 100 lb. of lead. It is claimed that this pot has advantages of quick heating, compactness of design and reliability.

Trent 100-Lb. Electrical Melting Pot

A cast terminal box is provided at the bottom of the pot for BX connection or connection to a rigid metal conduit. The terminals are placed horizontally from the side walls of the casting so as to facilitate connection and inspection.

The pot is made portable by means of semi-rigid eye bolts secured on the rim of the casting. These are also useful when pouring the metal direct from the pot. The crucible is of a special grade of cast iron and the shape has been carefully proportioned to withstand the strain incident to the heating and cooling of this mass of metal. The casing is made of sheet steel with welded seams reinforced with steel bands.

It is recommended that temperature control apparatus be used in connection with this pot so as to prevent overheating. The pot can also be used for melting salts requiring less than 1000 deg. F.

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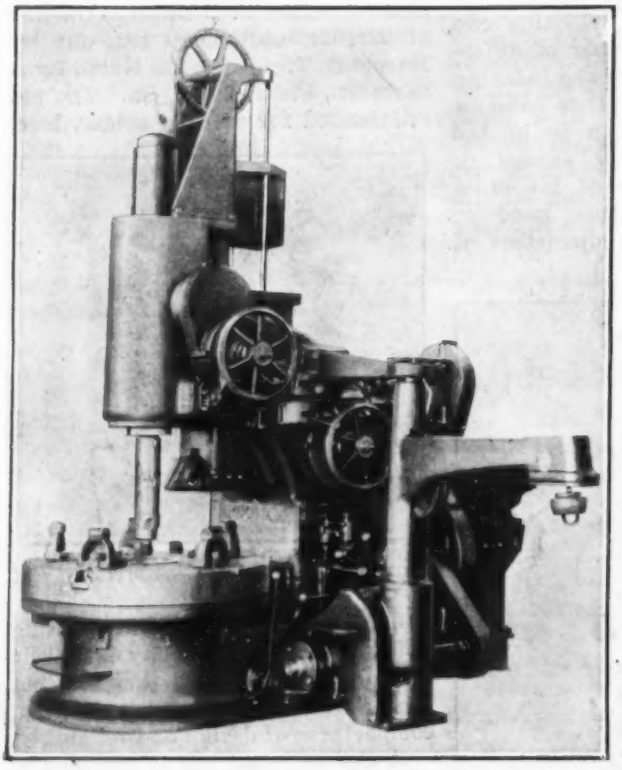
Putnam 48-Inch Car-Wheel Boring Machine

The Putnam Machine Division, Manning, Maxwell & Moore, Fitchburg, Mass., has redesigned the heavy car-wheel boring machine shown in the illustration. This machine has a capacity to bore wheels from 16½ to 42 in. in diameter as measured over the treads. It is furnished with a hand-operated, pneumatic, or automatic power-operated chuck as desired. The chuck spindle is hollow, providing free passage for chips to a pit beneath the machine and obviating the possibility of their getting into the bearings.



Putnam 48-Inch Car-Wheel Boring Machine

The vertical boring spindle has been made longer and larger in diameter, and provision is made to compensate for wear by means of adjustable split tapered sleeve bearings. It has rapid traverse by power in both directions and four changes of feed. An automatic trip disengages the power movement before the spindle reaches its limit of travel. One lever controls both feed and traverse.

The horizontal ram for facing the hubs of wheels is similarly equipped with respect to its power movements and is also controlled by a single lever. Both levers are placed within easy reach of the operating position.

The counterweight to balance the boring spindle is provided with guide-rods, and at its lowest position enters a well at the top of the column, thus preventing it from causing serious damage in the event that the cable should break. The table drive has been improved by the employment of a forged nickel-steel pinion meshing with an accurately cut gear of high-carbon steel. The pinion is supported by ample bearings of bronze on both sides, thus eliminating overhang. The thrust of the cut is taken upon an annular track of large area, running under flood lubrication from an oil reservoir. The machine may be equipped with either mechanically operated or pneumatic cranes as desired. Cranes may be furnished for one or both sides of the machine. The pneumatic crane is controlled by a single lever, so arranged that after once setting the valve no further attention need be given to it. The load can be stopped in any predetermined position. The mechanically-operated crane derives its power from a separate motor through friction clutches.

The main drive to the machine is through a self-contained gear box, giving four speeds in geometric progression. All gears in the gear box run in oil, and all bearings are bronze bushed. Except the motor pinion and its mating gear, the gears are of heat-treated alloy steel. The gear shift is of the selective type, and it is impossible to engage conflicting trains. A friction clutch is employed in the drive to start the machine, and a movement of the lever to disengage the clutch automatically applies a friction brake.

The machine may be driven by belt to a constant-speed pulley, or by a direct-connected motor. By using an adjustable speed d.c. motor the gear box may be omitted and the armature shaft of the motor coupled to the pinion shaft of the table drive.

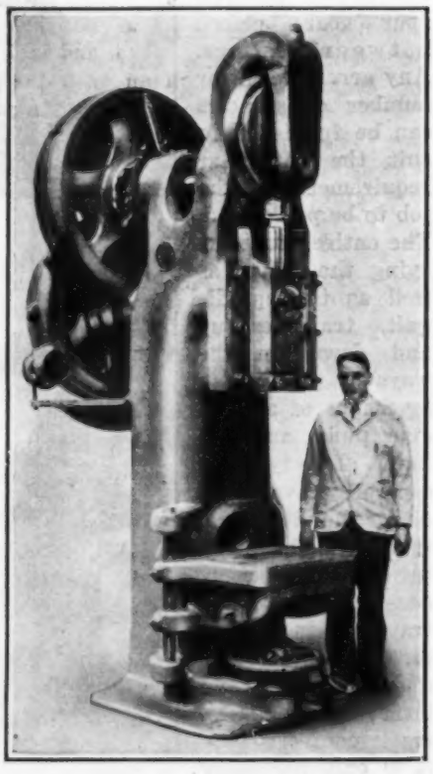
The floor space required, including the swing of one crane, is 10 ft., 9 in. by 12 ft., 2 in., and the machine stands 11 ft., 7 in above the floor.

Ferracute Long-Stroke Press

The Ferracute Machine Co., Bridgeton, N. J., has placed on the market a series of presses having abnormally long strokes and other special features. The press shown is the fifth in the series.

The stroke of the ram is 12 in., and the distance from the bed to ram is also greater than usual. This stroke is obtained by means of an eccentric keyed to the drive shaft.

The bed is adjustable. In its high-



Ferracute Long-Stroke Press

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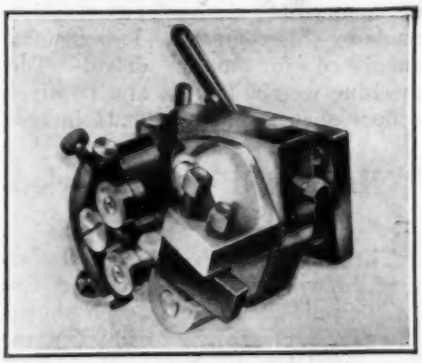
est position, its height from the floor is 33 in., from which it has a downward adjustment of 8 in. When not in use the bed may be swung out of the way. Heavy bolts secure the bed to the frame and planed guides at the back insure positive alignment. In order to provide additional safety the flywheel and gear is webbed and incased in guards. The press is equipped with a motor shelf adapted for use with an electric motor driving through a rawhide pinion to the flywheel, which has teeth cut in its rim. A horn set in the horn-hole at the front of the frame allows the machine to be used for such operations. While the press has been designed for certain forming operations in an automotive factory it is adapted for a wide range of work. The total weight of the press is 15,300 pounds.

Warner & Swasey Single-Cutter Turner

The Warner & Swasey Co., Cleveland, Ohio, has brought out an improved design of tool for the turning of single diameters on bar work. Due to its rigid construction, it is claimed that the maintenance of correct diameters is assured for heavy as well as for light cuts.

The cutter block swings about a hardened and ground stud and the cutter itself is held in an open slot



Warner & Swasey Single-Cutter Turner

by means of two screws. This construction is said to permit turning very close to shoulders, collets, or a fixture. The cut may be set to precede or to follow the rolls on the roller back rest. The tool can be easily adjusted for use with various diameters and is quickly withdrawn after a cut.

Two rolls are provided on the roller back rest. With this roller construction it is claimed that higher cutting speeds may be used than with turners that are fitted with ordinary solid back rests, and that the rolls also leave a much better finish. Both rolls and studs are made from hardened steel and are mounted on sturdy swing jaws. They are adjustable to the work by screws and can be clamped in position by means of a binder handle.

A hole is provided in the body of the tool to allow stock smaller in diameter than turret hole to be run through it.

Tuthill Reversible-Flow Pumps

An improved type of gear pump, designed especially for machine-tool purposes, has been marketed by the Tuthill Pump Co., 131 West 63rd St., Chicago, Ill. Advantages claimed for the pump are that it simplifies installation and renders a

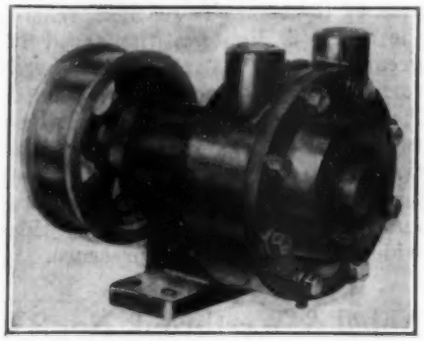


Fig. 1—Tuthill Reversible-Flow Pump

longer service life. It is illustrated in Fig. 1, assembled.

Following the general lines of the internal-gear pump, it comprises a housing in which rotates an internal or driving gear, and a driven gear, as illustrated in Fig. 2. The driven gear, together with a crescent member, is mounted in the cover so that when the unit is assembled the space within the internal gear is completely filled. The pumping action is produced when the teeth unmesh on one side and draw in the liquid. The liquid then is carried past the crescent member to the opposite side where it is forced out by the meshing of the teeth. The action is continuous, and the stream, non-pulsating.

The space between the intake and the discharge sides is sealed by a hardened-steel land that is held in place by a light spring. This member, being subjected to the oil pressures above and below it, adjusts itself vertically to maintain the amount of flow allowed at the discharge. When pumping the full amount, it is close to the rotor-gear member, causing a seal between the two sides. When the liquid is shut

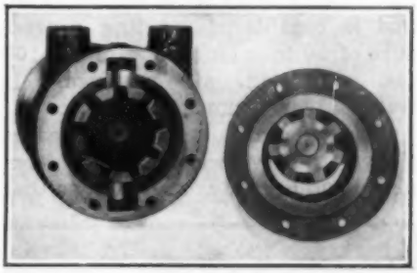


Fig. 2—View showing the pump dismantled

off at the discharge, the pressure causes it to raise and allow the liquid within the pump to by-pass, eliminating the necessity of a by-pass unit. The balanced lands of the pump allow small chips, grit and other particles to pass without cutting away the closely fitted walls.

The crescent and the idler gear are mounted on a separate member that in turn is attached to the cover. By rotating the cover 180 deg., the direction of rotation is reversed. This motion in turn causes the stream to be pumped in the reverse direction thereby giving the reversing action necessary for miscellaneous machinery. There are no ball checks used in the pump. It is claimed that the reversing is simple and foolproof and that the action is positive. Both ports are turned in an upward position forming a trap that holds part of the liquid in the pump at all times, thus keeping it prime. This feature, in some installations, does away with the usual ball checks or foot valves employed in the end of the suction pipe.

Other improvements are a larger shaft and gears made of hardened steel. The packing is made of rolled-lead foil and graphite. Standard mounting specifications, such as bolt holes, belt widths, belt centers and shaft heights, are incorporated so that the pump can be mounted on machine tools without modifications.

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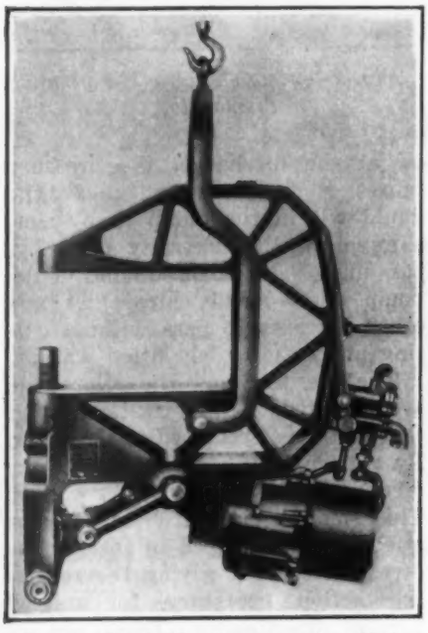
Hanna Portable Compression-Yoke Riveter

The portable compression-yoke riveter shown in the accompanying illustration is being marketed by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. One of the features of the machine is the alloy steel truss frame construction which gives rigidity and strength with a minimum of weight. This riveter has a reach of 24 in., a gap of 15 in. and is capable of exerting a pressure of 50 tons on a rivet die at 100 lbs. per sq.in. air pressure. It weighs 1,500 pounds.

When the machine is suspended as shown, the rivets are inserted from above and headed from below, so that



Hanna Portable Compression-Yoke Riveter

the rivets may be placed far in advance of the riveter. This procedure is said to enable the "rivet sticker" to give a portion of his time to drift pins and stitching bolts without interrupting continuous riveting. The machine may also be suspended with the dies vertical and the cylinder up, or with the dies horizontal and the cylinder up.

The method of mounting the air actuating cylinder is such that the distance from the inside top surface of the live stake to the bottom of the rear cylinder head is only 29 in. Hence it is said that the riveter may be used where girders are laid down for riveting, in which case the height is usually influenced by what is most desirable when reaming.

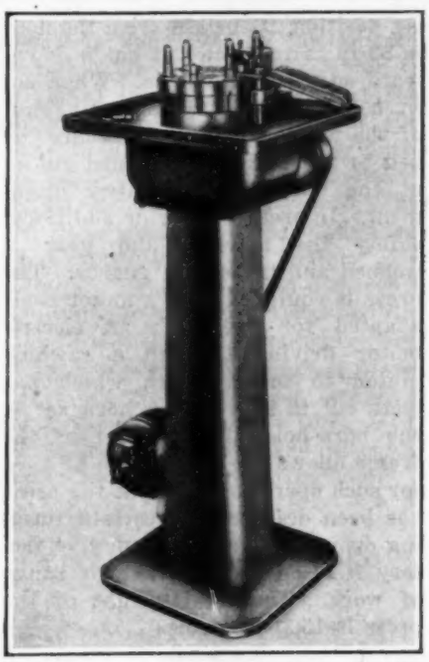
The control of the intake and exhaust air is through a Hanna combination operating valve, which is a distinct unit mounted at any convenient location and operated either by hand or foot. Two air hoses, with an inner area equivalent to that of a 1-in. pipe, lead from the valve to the cylinder. The valve combines both a balanced poppet and a balanced piston type, so that it is both air tight and free moving. It is claimed that any slight leakage from the valve will be from the machine to the exhaust rather than from the line to the machine or the line to the exhaust.

The pressure-exerting mechanism is a combination of simple lever and toggle which combines a long die stroke with a wide range of uniform pressure. The first part of the stroke is very rapid as the upper part of the die approaches the work. The die or plunger speed gradually decreases until the uniform pressure area of the stroke is reached. Where the work is lightest, the speed is greatest, and, as the rivet head forms, the pressure increases until it reaches a maximum which it maintains for several inches of piston travel. Ordinary variations in rivet lengths and plate thicknesses are automatically taken care of by this wide range of uniform pressure.

Nobel & Westbrook No. 21 Rapid-Production Marking Machine

The Nobel and Westbrook Manufacturing Co., Hartford Conn., has developed the No. 21 rapid-production marking machine shown in the accompanying illustration. It is capable of marking a large variety of short cylindrical parts on a production basis. These parts include such pieces as ferrules for tool handles, light sockets, parts of cigar lighters, bronze bushings, spark plug parts, and so on. In the unit pictured, automobile cigar lighter parts are being marked.

A horizontal revolving dial carries the parts to be marked. It is rugged in construction and is driven by means of a wormwheel and runs continually in a bath of oil. Thin articles such as ferrules or tubular articles are placed on mandrels as shown. The dial revolves and carries the work across the face of the die, which gives the desired mark. The work is unloaded automatically through a cam-operated unloading device. In the set-up shown, about 125 pieces per minute can be marked.



Noble and Westbrook No. 21 Rapid-Production Marking Machine

The machine is a floor type machine and stands on a pedestal. It is an improvement over a bench type of somewhat similar construction made by this company. It is usually furnished for motor drive. The machine weighs 200 lb. and requires a floor space of about 20x24 inches.

"Hallowell" Steel Work Benches

The Standard Pressed Steel Co., Jenkintown, Pa., is marketing the "Hallowell" steel work bench shown in the accompanying illustration. The entire bench is made of steel of sufficiently heavy gage to withstand the abuse to which it will be subjected. By suitably flanging the front and back edges of the table, both stiffness and appearance have been attained. A back board and end pieces are provided in order to prevent the loss of pieces rolling off the top. A flange steel stringer ties the bench legs together.

The drawer is suspended from a

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suitably designed carrier frame which rests on the inturned flanges of the steel bench top. The entire drawer unit can be slid along these flanges and located at any desired position by tightening the clamping bolts.

The benches and tables are made

"Hallowell" Steel Work Bench

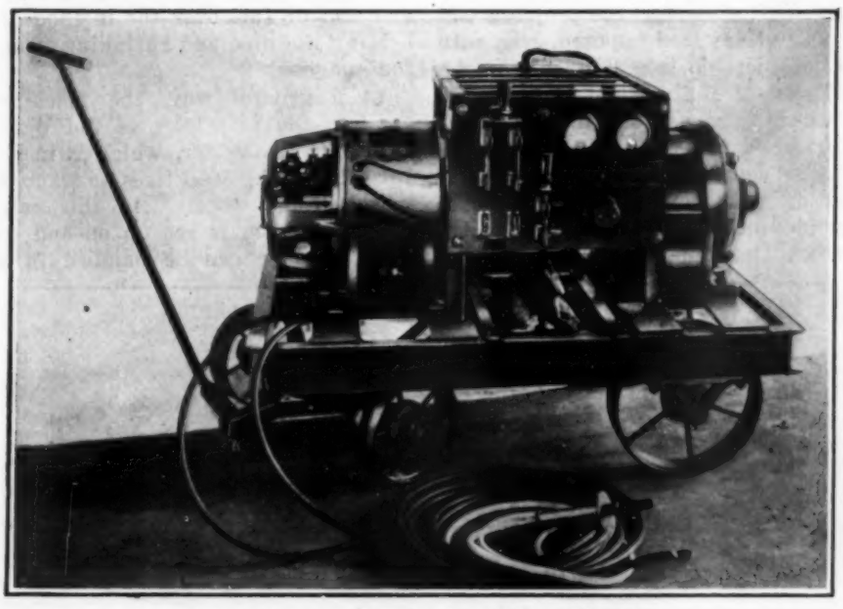
in three lengths, 3, 6, and 9 ft.; 4 heights, 25, 29, 31½, 33½ in.; and two widths, 29½, 23¾ in. Two weights of top can be obtained, ½-in. heavy steel, or ⅛-in. medium steel. Sections can be added together to make benches of any desired length.

Wilson Improved Type S Welding Machine

The Wilson Welder & Metals Co., Inc., Hoboken, N. J., has increased the welding capacity of the standard Type S "Plastic-Arc" welding machine to 300 amp. The complete rating of the equipment, according to the American Institute of Electrical Engineers, the Power Club, and the American Welding Society Standard, is 200 amp. continuous duty on fixed resistance; 250 amp. for one hour, with 50 deg. rise on fixed resistance; and 300 amp. continuous hand welding.

A feature of this machine is that it is possible to weld metal of a minimum thickness of ⅛ in. as the machine is equipped with a shunt field booster resistance, by means of which the operator is enabled to lower the current to 25 amperes.

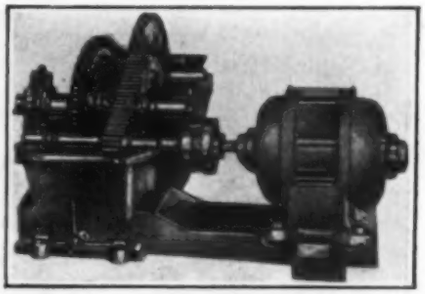
This company is also bringing out a machine of larger capacity with a range of 25 to 350 amp. It is of the same design as the standard Type S machine; complete rating is 250 amp. continuous duty on fixed resistance; 300 amp. for one hour, with 50 deg. rise on fixed resistance, and 350 amp. continuous hand welding. This machine is particularly well suited for railroad and shipyard welding.



Wilson Improved Type S Welding Machine

Washington Roller-Chain Speed Reducer

The Washington Machinery Depot, Tacoma, Wash., is marketing a speed reducer unit using roller chain made by the Diamond Chain & Manufacturing Co., Indianapolis, Ind. On the main drive triple-strand chain is used, and on the two reduction drives, single strand. The entire mechanism is inclosed in an oil bath.



Washington Roller-Chain Speed Reducer

It is said that the use of roller chain permits the transmission of power in one direction without the use of idlers. Furthermore, it is claimed that the particular advantage of this design is that the original transmission efficiency and silent operation is preserved because of the inherent characteristic of roller chain, whereby any wear on the chain or the sprockets is automatically absorbed by the chain riding higher on the cut steel sprocket teeth. This type of drive is quite accessible.

Oesterlein Motor-Driven No. 3 Universal Tool-Room Grinder

A motor-driven No. 3 universal tool-room grinder is announced by the Oesterlein Machine Company, Cincinnati, Ohio. The capacities and design are identical with the belt-driven No. 3 machine and the belt- and motor-driven No. 2 grinders made by this company. The motor-driven machine is entirely self-contained and its chief features are a direct-connected motor and the complete elimination of belts.

A 1-hp. motor is used to drive the wheelhead, to which it is connected by a flexible coupling and intermediate gears with final drive through spiral gearing. The intermediate gears provide two wheel speeds. This wheel head motor is mounted on the column and the entire unit may be swiveled 90 deg. in either direction.

An inclosed motor, mounted at the rear of the machine, furnishes power for the workhead, the power feed mechanism and a coolant pump. By means of a selective gear box, three workhead speeds are available. The final drive is by worm and wormwheel. Three rates of automatic table feeds are also provided. The

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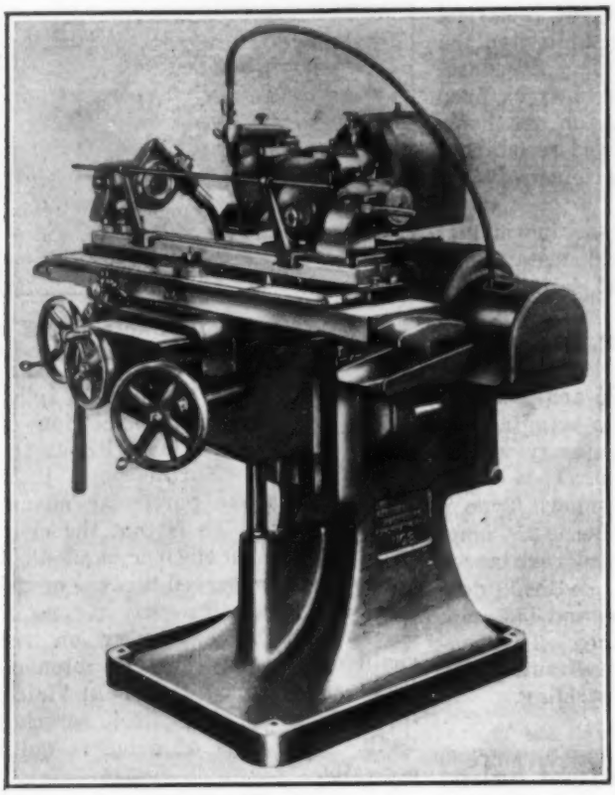


Oesterlein Motor-Driven No. 3 Universal Tool-Room Grinder

power comes from a geared feed box, through a telescoping universal-jointed shaft to the table feed mechanism in the knee. The pump is direct driven by a gear from the end of the armature shaft.

In addition to the three rates of automatic power feed, three means of hand reciprocation of the table are available: a high- and low-ratio table feed by means of a handwheel, and a lever feed that is used for quick, short-stroke table reciprocation.

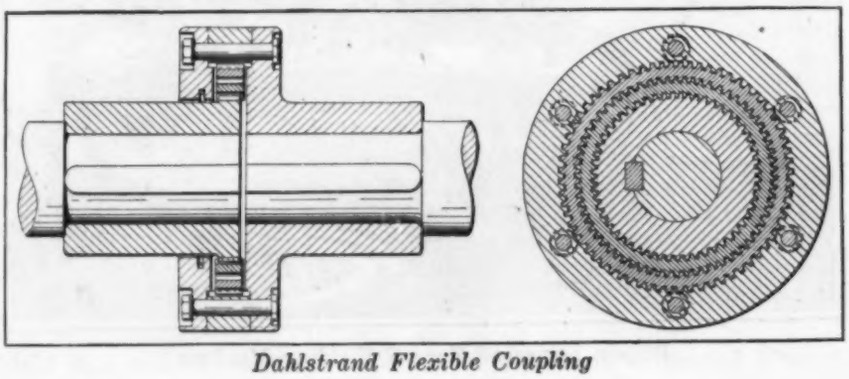
Dahlstrand Flexible Coupling

The flexible coupling shown in the accompanying illustration was brought out by J. Y. Dahlstrand, Scio, N. Y. The coupling consists of two hubs keyed to the driving and driven shaft, respectively. One hub has externally hobbed claws somewhat similar to gear teeth, although not of a gear tooth profile. The other hub has bolted to it an internally cogged member of much larger diameter. In addition there are two floating rings with teeth on both the inside and outside circumferences that are interposed radially between the two hubs; one of these floating rings is split. The whole assembly is tightly closed and is lubricated by means of grease, which is injected through a connection in the side of the coupling.

The coupling is made of steel throughout so that it can be operated at high speed. It is free to move endwise to the extent of ¼ in. without imposing any thrust on either of the rotors. It is designed to permit of a considerable degree of angular misalignment and to have torsional flexibility. In the case of suddenly applied loads the film of lubricant between the various tooth surfaces acts as a cushion.

The coupling will also take care of a certain amount of lateral misalignment in which case all of the teeth will not be engaged at one time. Since the tooth surface is in excess of four times that necessary to transmit the loads to be carried by the shaft diameter, the coupling will transmit any load imposed, even with a considerable lateral misalignment. Alignment of the coupling is readily checked by measurement with a gage furnished with it.

The coupling can be disconnected so as to permit operation of the prime mover without running the driven machine, or vice versa, as with duplex drives, without completely dismantling the coupling. It is only necessary to unbolt the cover and to remove the inner split floating ring, thus entirely disengaging the two coupling members.



Dahlstrand Flexible Coupling

Hardie-Tynes Air Compressors

The Hardie-Tynes Manufacturing Co., Birmingham, Ala., has announced the addition of a line of air compression machinery. The compressors can be operated either by electric or steam motors and are equipped with an improved valve system patented by this firm.

West Hydraulic Pipe-Compressing Machine

The machine shown in the accompanying illustration was brought out by the West Tire Setter Co., Rochester, N. Y., for compressing the ends of wrought-iron pipe on to cast-iron end pieces or gudgeons carrying shaft ends. This construction is used in making rolls for printing presses, rolls for power ironing machines or mangles, and similar equipment. Pipes ranging in diameter from 2½ to 12 in. and from 10 to 12 ft. in length can be handled.

The compressing is done cold and it is claimed that this method results in considerable saving in time and cost of fuel over the method of heating the pipe and shrinking it on the gudgeon.

In a general way, the machine employs the principles of the West hydraulic tire setter, which is made for cold setting steel tires on wagons and carriage wheels. In this case the mechanism is set up on end so that the pipe can be handled in a

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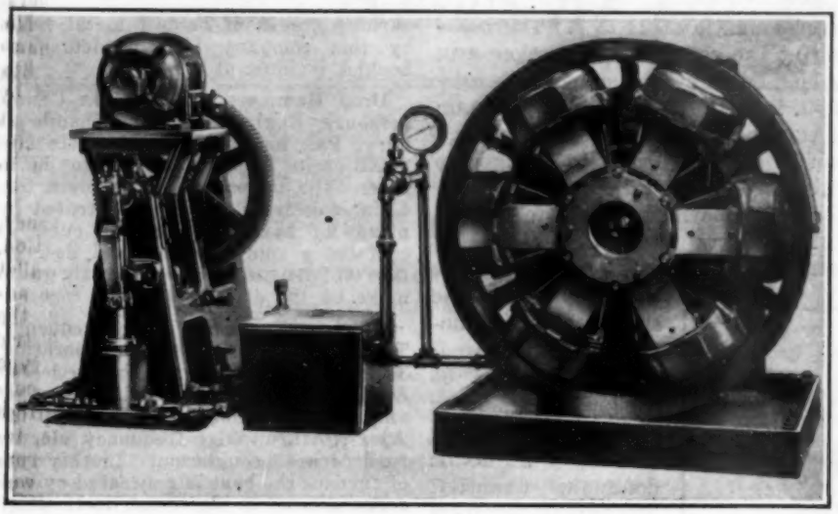


West Hydraulic Pipe-Compressing Machine

horizontal position. The machine consists of a series of hydraulic rams set around the interior of a heavy steel ring. The mechanism is mounted on a suitable base and the rams slide in toward the center as the pressure is built up in the several cylinders. Blocks or dies of suitable construction are used to handle pipes of various diameters.

A multiple-cylinder pump is furnished for supplying the necessary hydraulic pressure.

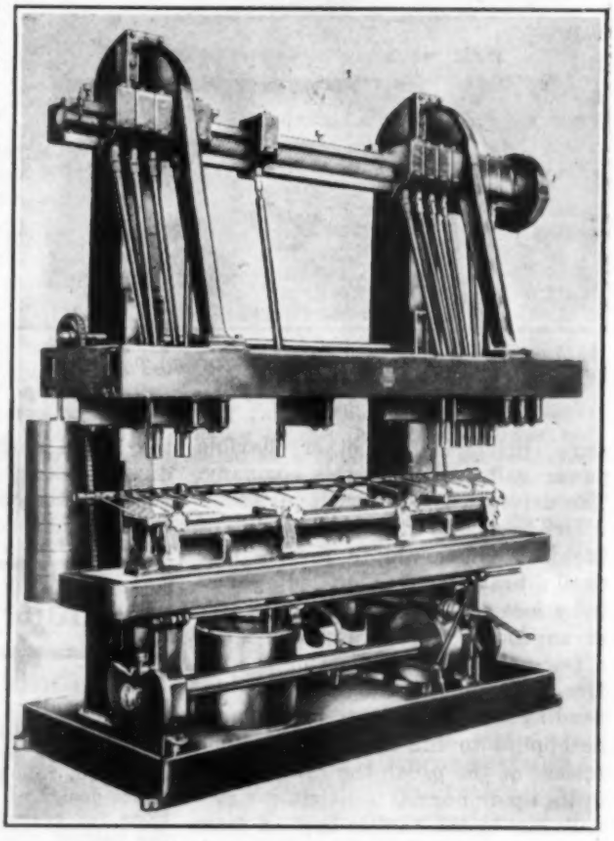
"Hole-Hog" No. U-12 Drilling Machine

The Moline Tool Co., Moline, Ill., has developed the "Hole Hog" No. U-12 drilling machine with a jig and the necessary spindles for the drilling of tractor frames made of wrought-iron rectangular tubing. Since the drive to the drills is through the universal-jointed and telescoping shafts, the machine may be adapted to any production drilling of holes within an area 8 ft. long by 12 in. wide. The minimum center distance between spindles is 1¾ in. Similar machines having from one to four columns and in lengths from 2 to 24 ft. can also be furnished.

The drive is the spiral gear type developed by this company for their "Hole Hog" line. The main drive shaft is driven by means of a belt from a countershaft or motor, and is mounted on radial ball bearings. The shaft is geared to the main spiral which is hardened and lapped. Independent driving units carry bronze gears that mesh with the hardened spiral. They are adjustable laterally along the upper rail. These driving units are made in multiple where it is advantageous to do so. A centralized wick system is used to lubricate both the heads and the universal joints.

The lower rail is a box section of liberal proportions. Two T-slots are provided on each side for clamping the spindle housing. Due to the large distance between the universal joints, only slight angularity of the telescoping drive shafts results, so that little wear takes place in the universal joints. The spindles are made of heat-treated steel of liberal dimensions. The ball thrust bearings are also of large proportions, and it is their diameter that determines the minimum center adjustment of spindles. In order to accommodate the various lengths of drills, the spindles have a vertical adjustment of 1½ in. This adjustment is obtained in the following manner; the long bronze bearing of the spindle is threaded at the upper end and screwed into the upper part of the spindle housing, which is tapped to conform with the bushing. The bushing is threaded left handed to prevent any possibility of turning while the drills are in operation. In addition to being threaded, it also carries a spur gear which meshes with a spur gear carried on an adjusting shaft parallel to the spindle. When the head is in a drilling position, this shaft is locked.

The feed and table mechanism is of standard construction. The cam is designed to give the table quick approach, slow feed and quick return. The table has a 5 in. vertical adjustment independent of the cam travel. In the particular machine shown, the jig is made to accommodate both right and left hand frames having the necessary drill guide bushings. The clamping of work is accomplished by four screws, which can be swung out of the way to clear the work as soon as they are loosened. The jig is designed to give a minimum of chip trouble by having the work rest on hardened Vs.



"Hole-Hog" No. U-12 Drilling Machine

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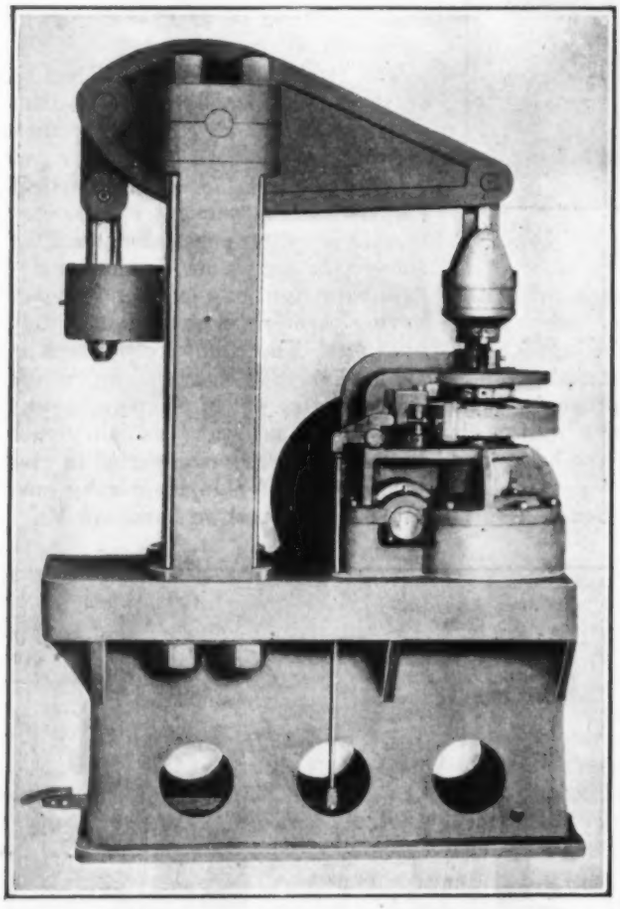
General Manufacturing Co. 60-Ton Flexible Power Press

The 60-ton flexible power press shown in the accompanying illustration is being manufactured by the General Manufacturing Co., Detroit, Mich. The machine operates on the same principle as other flexible power units made by this company. The drive is by a worm and worm-wheel to a screw jack. The nut of the jack is allowed to revolve free until a brake band is applied against it by means of a treadle. With this arrangement the operator can apply a few pounds on the ram or the entire capacity of the machine, depending on the amount of pressure he applies to the foot pedal. Upon release of the pedal, the ram returns to its up or normal position.



General Manufacturing Co. 60-Ton Flexible Power Press

Power to the ram is applied from the rear drive-head screw jack through a rocker arm, having a leverage ratio of 2½ to 1. The bearing at the center of the rocker arm is held down by means of four posts, 3 in. in diam. The main front ram is equipped with a nose piece, which can be easily replaced or changed to suit different work.

Such a machine is said to be useful for straightening heat-treated parts such as front axles, rear axle shafts, and spline shafts for automotive use. The machine can also be used where there is any straightening or bending work to be done in quantity. The ram of the press has a total stroke of 4 in. and operates at a speed of 48 in. per minute. The maximum distance between the up position of the ram and the table is 21 in. The distance from the center of the ram to the front of the column is 6¾ in., while the distance from the center of the ram to the front of the table is 6 in. The table is 24 in. wide and is 30 in. high. The drive is by a pulley 24 in. in diameter by 6 in. face, rotating at 300 r.p.m. The machine occupies a floor space of 36x60 in. and has an overall height of 88 in. The net weight of the belted model is 6,600 lb. If a direct motor drive is desired, a 10-hp. motor operating a 1,200 r.p.m. is recommended.

Trade Catalogs

Babbitt Metal. The Hoyt Metal Co., St. Louis, Mo., has published a small pamphlet entitled "Babbitt Metal Data." Selection of babbitt metal is discussed, followed by a consideration of the design of such bearings. Instructions for preparing for the casting of the babbitt, the casting itself, and the fitting of the bearings are given. A table of physical constants of the various grades of babbitt metal made by this company is appended. The booklet is illustrated.

Drop Hammers, Steam. The Chambersburg Engineering Co., Chambersburg, Pa., has published bulletin No. 205-B on its Type "B" steam drop hammers. The bulletin contains eight 8½x11-in. pages and is well illustrated by means of halftones and line cuts. It contains a complete technical description of the various parts that go to make up the drop hammers.

Electric Furnaces, High-Frequency. The Ajax Electrothermic Corporation, Trenton, N. J., has published a leaflet entitled "Steel Melting." In it the advantages of melting steel with the Ajax-Northrup high-frequency electric furnace are brought out. In this type of furnace the heat is generated by currents induced in the metal itself. High speed of operation and cleanliness, together with accurate temperature control are claimed. The bulletin is well illustrated.

Milling Machines. The Brown & Sharpe Manufacturing Co., Providence, R. I., has published a 160-page catalog on its various types of milling machines. The publication is 8½x11 in. in size and is attractively bound and profusely illustrated throughout, largely by halftones. The line of milling machines illustrated is unusually complete and it includes universal and plain machines of various sizes for toolroom and production work, vertical spindle machines, manufacturing type units, and automatic machines of three types for the rapid and economical production of duplicate parts. The particular features of each type are explained in considerable detail. Emphasis is placed on the accuracy, stability, and speed of handling of all the machines discussed.

Tramrail System. The Cleveland Electric Tramrail, Division of the Cleveland Crane and Engineering Co., Wickliffe, Ohio, has issued a leaflet, entitled "Tramrail Engineers can show you how to Move It," in which this type of conveyor is illustrated in plants of a wide diversity of products, such as lumber mills, founderies, etc. The presentation is largely pictorial.

Pamphlets Received

Costs, Standard. The standard cost system as a means of controlling costs in manufacturing concerns is described in a 28-page bulletin, entitled "Standard Costs" issued by Ernst & Ernst, 80 Maiden Lane, New York, N. Y. The booklet discusses such subjects as budgeting, budget control, labor cost, burden rates and a method of taking care of variations. The relation of timely knowledge to selling prices and profits is explained, and the advantages of standard costs are made evident.

News of the Week

France Looks to Financial Stabilization as Guide Post to Prosperity

Metal working industries are awaiting readjustment

By Our Paris Correspondent

The present situation is based wholly upon an economic foundation. The rise in the gold value of the franc, rapid as it has been, has had the effect of immediately curtailing the volume and value of exports and concurrently has encouraged imports.

The home market to which the manufacturer must ultimately appeal has not benefited from the general lowering of prices which was looked for. Certain manufacturers and tradesmen who, prudently, had accumulated no great stocks of material or merchandise, and accordingly do not find themselves overloaded with high-priced inventories, are comparatively safe. They have only to liquidate progressively and meet no great loss. Others will perforce have to take their losses as they had hoped to take their profits—on a speculative basis.

Consumer pressure will play its part sooner or later though it is thought that no great buying market will develop for long to come. In any case the bulk of the consuming public will await a more considerable fall in prices than is at present in view. This does not prophesy good times at any near date.

Tools Still High

Living costs are still at a high level though there have been drops on a few items. Clothing has dropped in price. A monkey wrench, a sledge hammer, an electric borer or a bicycle chain, or an aluminum stew-pan sells today at as high a figure, with the dollar below 26 francs, as it did when the dollar was quoted 40 francs. Gasoline has been reduced a few centimes a gallon but this of itself is not helping the automobile industry.

The Bank of France balance sheet still shows abnormal, and in a way inexplicable, fluctuations. The government recently covered a billion francs of its advances and note circulation was reduced three quarters of a million or more; but the week ending Dec. 2 showed further advances to the state of over a billion and an increased note issue of seventy millions.

Labor conditions are by no means unsatisfactory, though the automobile industry is, for the most part, working on short time. A communist agitation broke out in the foundry trade in the Paris district and the chief journal of that faction announces "a labor crisis more serious than that of 1920" as being not far away. All is based on the prospects of a probable diminution of the wage scale by employers at an early date, if, or when, the franc is stabilized or revalorized. Either of these possibilities is fraught with difficulty for labor and industry alike; indeed the latter fears a crisis at a not very distant date if the gold value of the franc proceeds too rapidly from this point onward. For labor, living costs must drop coincidentally with wages or a similar complication will arise.

Better Methods Sought

An important conference has been held under the chairmanship of Monsieur de Freminville, of the Creuzot establishment, co-operating with the Comite National de l'Organization Francaise. The object, as stated, is to seek out "better methods of production and labor in the mechanical industries by the adoption of appropriate advanced scientific methods."

The mechanical industries of the Paris district have notably slowed down the last weeks, due to a lack of spot orders and the uncertainty of manufacturing for stock under the fluctuations of the franc, which for the past fortnight have jogged up and down each forty-eight hours. Manifestly production under such conditions is practically impossible with fixed selling prices in view.

The automobile industry has been affected by the indisposition of its furnishers to fix prices of castings, stampings and what not, with delivery dates spread over a period of some months. The final turn of events here is not to be prognosticated as yet, but it resembles the state of affairs which existed a couple of years after the armistice.

In the Rhone valley around Lyons the metallurgical and machinery trades find their wage bill has increased from 17 to 22 per cent since February last, and methods are being sought which shall content all interested when the readjustments are made. It is generally recognized that so far as production methods are concerned the progress here has not kept pace with that elsewhere, referring especially to the United States.

The foundry interests claim small demands from the automobile industry as compared with recent years. General railway and rolling stock hardware and accessories are finding some call but the Ardennes stamps and forges are suffering from curtailments in the automobile industry.

The agricultural machinery trade is slowing down as far as new orders are concerned, but the future is optimistically regarded. There is some activity in French shipyards and a notable improvement is shown in plants catering to railway rolling stock and motive power. Some export business has been booked for Egypt, India and Spain. Trials are still being held by the railway commission looking to the ultimate adoption of "continuous" brakes but no definite decisions have been arrived at.

The screw and bolt combination has established a new ratio of price advances running from 70 to 158 per cent above list prices as published. Tools in general have felt the effects of rising value in the franc and prices are unstable with little likelihood of an immediate drop. Files and vises, metal saws, pincers and various other items in the small tool category are quoted at 10 to 25 per cent over the prices of 1925. This is hardly more than enough to cover increased overhead and trading charges. Orders have slowed up and few firms are in a position to make prompt quantity deliveries from stock. Wrenches and files are notably in this category and demand delays of from one to two months.

Exports and Imports Increase

Ten months' sales abroad still show an excess as compared with the same period in 1925, but have diminished during the past month. The total increase of exports to the United States is 663,366,000 francs.

Imports have increased more than thirteen billion francs, of which more than a billion increase is to be credited to Great Britain, two billions to Germany and a billion and a half to the United States. The trade balance for the period in favor of the United States is 3,282,627,000 francs.

H. C. L. Going Up

A further increase in the cost of living in the United States was indicated as a result of the November investigation of the National Industrial Conference Board. The index number for the total cost of living increased from 167.2 in October to 168.2 in November.

The usual seasonal increase in retail food prices was evident in a two point advance of the food index number. The only other change of significance was the ten point advance in the index number for fuel which was due partly to the seasonal increase in price and partly to the British coal strike which has resulted in a large exportation of American bituminous coal.

The purchasing value of the dollar based on the cost of living was 59.4 cents in November, 1926, as compared with $1 in July, 1914.

Electric Crane Builders Form Association

At a meeting held in Washington on Dec. 6, the final details of organization were effected in connection with the Electric Overhead Crane Institute. This organization is the result of several meetings held by crane manufacturers, representing practically the full capacity in the electric overhead crane industry.

The organization of the Electric Overhead Crane Institute is another step in co-operative activity encouraged by the Department of Commerce and the United States Chamber of Commerce, and during the deliberation helpful suggestions were extended through the various bureaus of the Department of Commerce, as well as the United States Chamber of Commerce.

The manufacturers who are members of the institute are as follows:

Alliance Machine Co., Alliance, Ohio; Cleveland Crane and Engineering Co., Wickliffe, Ohio; Morgan Engineering Works, Alliance, Ohio; Milwaukee Electric Crane Co., Milwaukee, Wis.; Box Crane and Hoist Corporation, Philadelphia, Pa.; Harnischfeger Corporation, Milwaukee, Wis.; Manning, Maxwell & Moore, Inc., New York; Niles Crane Corporation, Philadelphia, Pa.; Whiting Corporation, Harvey, Ill.

The officers of the institute are: Henry W. Standart, president; Frank A. Hatch, vice-president; S. Buckley, secretary and treasurer.

S.A.E. Annual Dinner in January

The Society of Automotive Engineers will hold its annual dinner on Jan. 13 at the Hotel Astor in New York, during automobile show week there. An attendance of about 1,000 members and guests is expected to make this the largest social event of the week in automotive circles. Although the program of speakers and entertainment features has not yet been announced by the dinner committee, it is hinted that these will be worthy of the occasion and will equal if not surpass in quality those of former annual dinners of the organization.

Election of a new president of the society to serve during 1927 will be held in connection with the dinner. J. H. Hunt, head of the electrical division of the General Motors Corporation research laboratories, is presidential nominee, having been nominated at the semi-annual meeting of the society at French Lick Springs last June.

G. E. Inaugurates Relief and Loan Plan

The General Electric Co. has inaugurated a relief and loan plan whereby employees at the Schenectady works who are temporarily idle, working part time, or are in need of relief because of illness in the family or other emergencies in the home can borrow up to $200, without interest, and repay it by a deduction in instalments of 10 per cent of the weekly pay when back on full time again.

Any employee with the company more than one year is eligible for membership. Fifty cents a month is deducted from each member's pay, 5 cents going into a relief fund and 45 cents to be used as an unemployment loan fund.

The General Electric Co. members who leave the employ of the company after one year's membership will be refunded the amount deducted from wages less the amount contributed toward the supplementary relief fund.

Recommended Definitions for Scientific Apparatus

The following standardized definitions of pyrometric terms, as presented by the industrial group of the Association of Scientific Apparatus Makers, are recommended for general use. Each of the terms was defined only after wide discussion with the Bureau of Standards and other authorities, and the definitions combine the thought of a representative group.

A resistance thermometer is a thermometer which indicates temperature by means of the change with temperature of electrical resistance of one of its parts. It is a pyrometer when used at high temperatures (above 500 deg. C.), and in such case is preferably called a resistance pyrometer.

A radiation pyrometer is a pyrometer which indicates temperature by means of the change with temperature of the heat radiated by a hot body. As nearly as possible the total heat radiated is used.

An optical pyrometer is a pyrometer which indicates temperature by means of the change with temperature of the light emitted by a hot body. As nearly as possible light of a single color (wave length) is ordinarily used.

A thermocouple is a pair of electrical conductors so joined as to produce a thermal e.m.f. when the junctions are at different temperatures. It consists of conductors of different material permanently joined at one end, the other ends being free to connect to an instrument for measuring e.m.f.

A thermoelectric pyrometer is a pyrometer which indicates temperature by means of the change with temperature of the e.m.f. of a thermocouple.

Revised Trade Terms

Recognizing that the language of trade must have an exact meaning, the International Chamber of Commerce is preparing a revision and enlargement of its compendium of international trade terms. The trade parlance of 24 countries, instead of the 13 included in the original publication, will be defined in the new book.

The volume signalizes the progress made toward the development of a common tongue for traders of all nationalities. The method involves the use of such terms as F.O.B., C. & F., F.A.B. the world over.

The purpose of the chamber is to reduce to a minimum the misunderstandings growing out of different terms and clarify the language by which the world's trade is carried on.

Public Inspection of Arc Welded Building

Noiseless steel building erection was demonstrated before an inspection group of several hundred architects, builders, contractors and steel men at Sharon, Pa., on Dec. 15 and 16. These men were the guests of the Westinghouse Electric and Manufacturing Co. in the first public viewing of its five-story arc-welded steel building now approaching completion at the Sharon Works of the company.

The Sharon Works building is a skeleton steel structure, designed specifically for arc-welded construction. The floor dimensions of the building are 70 x 220 ft. and the structure is 80 ft. high.

The new building is an outgrowth of years of experimenting by welding engineers. Data so provided resulted in steel fabrication and design which provides greater strength at joints and makes for less steel in building. The Sharon building required 700 tons of steel while for a similar building of riveted construction 800 tons would have been needed.

Steel for the structure was fabricated in the plant of the American Bridge Co., at Ambridge, Pa., with the columns all welded in the shops before delivery to the field.

Japanese Government Aviation Plans

Because of the retrenchment program of the present Japanese government, the original estimates for civil aviation routes proposed by the Ministry of Communications have been severely cut. The proposal was to expend 7,000,000 Yen over a period of seven years for the establishment of new routes and to grant 20,000,000 Yen in subsidies to the operating company or companies, to be expended over a period of eleven years.

The final estimates, as approved by the cabinet, call for an expenditure of 628,000 Yen for preparatory work and 12,000 Yen for investigation of company organization and administration. It is announced, however, that the Minister of Communications will, during the coming budget year (beginning April 1, 1927), obtain sites and start the erection of hangars and observatories at Osaka and Fukuoka.

South American Buys Marine Engines Here

Leon Sanchez, of Barranquilla, Colombia, South America, has purchased from the Cummins Engine Co., at Columbus, Ind., several specially built engines for use on freight and passenger boats over a 600-mile stretch of the Magdalena River in South America. Discussing conditions in his country, Mr. Sanchez says it now is in a period of prosperity. The government, he said, is spending and plans to spend several millions of dollars on railroads and public highways within the next few years.

No Need for Worry Over Future Fuel Supply

In a paper on the "Motor Fuel of Tomorrow," presented recently before the American Petroleum Institute, at Tulsa, Okla., T. A. Boyd, of the research laboratory of the General Motors Corporation, discussed two main issues, first the prospect of our being able to secure fuel for the automobiles of the future; second the characteristics or properties of that motor fuel.

In treating of the first phase of the subject, Mr. Boyd said that he considered conservation in connection with increased production, improving refinery practice, improving cracking processes and modifying the constitution of gasoline to make its use possible in more efficient engines. He spoke of artificial processes of production, and in conclusion said: "Mindful of the fate of prophets, we are not going to make definite predictions about the prospect of motor fuel for the remote future; but it does seem that a careful analysis of the situation should not produce any pessimism about it. We know that there is a wealth of energy in the world. Our problem is not one of the supply of energy, but rather use of converting energy that already surrounds us everywhere into the form that will serve us best."

Mr. Boyd's discussion of the essential properties of fuel in the future motor was technical, dealing with the inherent qualities necessary to the most efficient results.

Europe Would Recover Aluminum Markets

European aluminum interests are considering a plan for united action in an effort to win back their prewar markets, according to reports reaching Washington. Some sort of combination which will permit of mass production and other steps toward lower costs is held to be necessary if the European manufacturers hold their own against American competition. American plates and sheets and other forms of manufactured aluminum are being exported in large quantities to European countries, as well as to other markets once supplied by European manufacturers.

Alien Population Gains

During the fiscal year ended June 30, 1926, says Secretary of Labor Davis, a total of 496,106 aliens was admitted and 227,755 departed, resulting in an increase of 268,351 in the alien population of the United States. This is against a net gain in the alien population of the country of 232,945 in the preceding fiscal year.

Of the 496,106 aliens admitted in the last fiscal year, 304,488 were immigrants or newcomers for permanent residence and 191,618 were non-immigrants returning from a short stay abroad or coming for a visit to this country. Two-thirds, or 150,763, of the aliens departed this year were non-emigrants who were either here on a visit or intend to return after a temporary sojourn in a foreign country. The remaining 76,992 aliens leaving during the year were emigrants intending to make their homes abroad.

Common laborers predominate among the outgoing aliens. Three-fifths or 33,107, of the total emigrants leaving the country during the last fiscal year and reporting occupations were of this class. Skilled workers rank second among those having an occupational status, and servants are third.

France Leads Europe in Machinery Exports

One of the changes which have taken place in the world's machinery trade since pre-war is the growth in the machinery export trade of France, states a report to the Department of Commerce. The improved status of France as an exporter of machinery today becomes even more significant when it is contrasted with the declining position of its chief European competitors, the United Kingdom and Germany.

In 1913 the machinery exports of France amounted to 82,000 metric tons. In 1925 this export total had risen to 172,000 tons, or considerably more than double the pre-war volume. In 1913 the United Kingdom enjoyed the great machinery export volume of 759,000 tons; in 1925 this total had decreased to 524,000 tons, representing a drop of 31 per cent. Similarly, Germany exported in 1913 671,000 tons of machinery; in 1925 this volume had fallen to 443,000 tons—a decline of 34 per cent.

The factors which to a large degree have placed France in this position may be stated briefly as follows: (1) Increase steel capacity, implying a plentiful and cheap supply of material to machinery manufacturers; (2) low labor costs; (3) depreciating currency.

In 1913, the pig iron capacity of France was approximately six million tons. With the ceding to France, by the Treaty of Versailles, of the Lorraine mines, together with the iron and steel mills in this region, the French pig iron capacity rose to approximately 11 million tons. The present steel capacity of France is now estimated in that country at 9,500,000 tons per year, which represents a percentage of increase over the 1913 capacity approximately the same as that shown in pig iron capacity during this period.

While the production costs of French machinery manufacturers have been in terms of the depreciating franc, their foreign sales have been on a gold basis at approximately world market prices. Thus, foreign markets have been particularly attractive to French machinery manufacturers and they have steadily increased their production to meet this growing export market. Under the favorable conditions cited, French machinery manufacturers have been able to improve the quality of their output, and this, in turn, has enabled them to continue to increase their export volume. While practically all conditions during the past three or more years have been favorable to exports of machinery from France, they have been more or less unfavorable to the machinery exports of other leading European countries.

Supreme Court Upholds Federal Act

The Federal Boiler Inspection Act, administered by the Interstate Commerce Commission, occupies the field as to regulation of equipment for locomotives and tenders to the exclusion of State legislation on this subject, the United States Supreme Court asserted on Nov. 29 in deciding as a unit three cases.

In the case of George M. Napier, Attorney General of Georgia, against the Atlantic Coast Line, there was involved a Georgia law of 1924 requiring locomotives used within the state to be equipped with automatic fire box doors. The Federal District Court granted an injunction to the railroad against the State law and this decision was affirmed by the Supreme Court. The appeals of the Chicago & Northwestern R.R. and the Chicago, Milwaukee & St. Paul R.R. against the Railroad Commission of Wisconsin involved an order of the State commission directing the carriers to equip locomotive cabs with a specific kind of curtain to protect engine crews from the weather. The railroads appealed to the State court and the Supreme court of Wisconsin sustained the State commission. In these two cases, the United States Supreme Court reversed the Wisconsin court.

The opinion, given by Justice Brandeis, holds that the Boiler Inspection Act is broad in scope and that it is practically impossible to separate locomotives used wholly in *intrastate* traffic from those used in *interstate* traffic and that the record shows that the Interstate Commerce Commission has broad authority under the act. Under all the circumstances, the court holds, the field of equipment of locomotives is fully occupied by the Federal government and hence that State legislation on the subject has no place.

Argentina Builds First Airplane Factory

The cornerstone for the first airplane factory in Argentina was laid recently at the city of Cordoba, Province of Cordoba, according to advices to the Department of Commerce. The ceremony was celebrated by army and civil air manoeuvers and signing of the contracts for the necessary construction work.

The factory is semi-official in character, its first purpose being to assure independence of imported air equipment in time of war. The factory will, however, in normal times construct planes for civilian customers as well as for the army.

It is estimated in Argentina that the plant will be able to construct complete airplanes within three years. The Argentine government has acquired patent rights for Lorraine-Dietrich motors, and for two years these will be only assembled in Argentina. The first planes will be of the Berguet type. This plane is reported to have already met with considerable success in Argentina.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current Developments

By Theodore H. Price
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"WE HAVE piped unto you and ye have not danced," is a Scriptural quotation that probably describes the feelings of those who had hoped that the recommendation of a stock dividend by the directors of the U. S. Steel Corporation would rekindle the fires of speculation in the security markets.

In the two days immediately succeeding the announcement there was some revival of activity, but it was short lived and as this is written comparative quietude prevails. The shares of a few corporations from whom stock dividends are expected later have advanced, and the securities of some of the railways that are included in the proposed Van Sweringen consolidation are also higher, but there has been no general buying and the offerings have been equal to demand.

The apathy is due to the widespread feeling that it is unlikely that the profits of 1927 will exceed those of 1926 and that since prices cannot go up indefinitely and never remain stationary the next movement will be downward. It must be admitted that there is some warrant for this feeling in the statistics that have been published from day to day.

The Department of Agriculture figures that at the prices current December 1 the more important crops will be worth $1,148,000,000 less than last year, and in making up its index number as of November 30 the Department of Labor puts the average value of farm products at 135 against 139 in October and 154 in November, 1925.

S. W. Straus & Co. announce that their reports from 481 cities indicate that the building permits issued during November contemplate an expenditure that was 14 per cent under last year, and they estimate the total cost of the year's construction at $6,200,000,000 against $6,500,000,000 in 1925.

Advices from the agricultural West and South are still somewhat despondent, and the Iowa Loan & Trust Co., one of the largest banking institutions in Des Moines, announced its suspension on December 20.

But the recession that these reports indicates does not appear to have had any effect upon the Christmas trade, nor has it resulted in any unemployment as yet. Therefore it would be premature to assume that business has a downward trend that will persist very long. The fundamental reason for the slight contraction thus far indicated is the decline in the value of our agricultural production. For this reason last week's advance in wheat, corn, rye and cotton is reassuring.

The rise in grain is attributed to a Government report on winter wheat that was somewhat less favorable than had been expected, and the improvement in cotton was attributed to ginning returns that were under anticipations. But the McNary bill and the possibility of its passage by the present Congress has also been a factor, for it is conceded that if it became a law the prices of corn, wheat and cotton would be stabilized at figures much above those now current.

In the circumstances it is quite natural that short selling should be restrained, at least until the 69th Congress has adjourned, and if a special session of the 70th Congress should be called an all summer embargo upon operations for the decline may be taken for granted.

Whether stabilization would be helped or impeded by the complete elimination of the short interest is a debatable question and an opportunity to ascertain the answer empirically ought to be welcome to the many economists who have argued that "bears" as well as "bulls" render a constructive service.

The problem of farm relief is in fact so many sided that its discussion will be most educational, and it is to be hoped that one result will be to make the industrial East more sympathetic with the needs and difficulties of the agricultural West and South.

In sugar, coffee and rubber the price changes have been unimportant. The cotton goods market has been toned up by the advance in the raw material, but the buyers who were waiting for a decline are still procrastinating.

Money has been distinctly firmer at 5½ per cent for call loans, but the advance is attributed to the holiday demand for currency and lower rates are expected after the New Year. An increase of $54,000,000 in the loans made to New York stock brokers is, however, commented upon as indicating some over expansion of credit, and during the next few weeks the Federal Reserve statements should be watched.

The news from Europe is in the main reassuring. The French franc has sold at 4.07 and Poincare is to be congratulated upon his success in imposing and collecting the taxes by which the credit of the nation has been saved.

In England the ease with which some large loans have recently been floated seems to indicate economic improvement. Lancashire is certainly doing better if one may judge from the demand for American cotton.

Taken all in all the year now ending has been one of remarkable progress here and abroad, and while the adjustments that progress implies are being made a slight slackening in the speed with which the world moves forward will not be surprising.

What's Doing in Industry

The last week in December brought a volume of business to machinery and machine tool manufacturers and dealers that was diversified as to types, scattered as to sources, and of a replacement character. Most of the orders received had been pending for some time and were closed as a matter of expediency so that their cost might be included in 1926 financial reports.

Inquiries increased in the week to the point where sellers were busy with quotations. Much of this business is for early delivery in 1927. Railroads were prominent as prospective buyers of machine shop equipment and it is believed that a good part of the business in January and February of the new year will be done with the carriers.

Automobile manufacturers have not as yet announced their plans, but it is an assured fact that some changes involving production lines will be necessary when the new models are announced and accepted by the public.

The important industrial centers report little activity in the last week of the year. Chicago business has been spotty, with a few orders from scattered sources. A large list of fresh inquiries gives reason for optimism in Indianapolis, automotive and railroad interests being active. In Cincinnati orders are ahead of expectations.

The New York market closed with some fair orders and with inquiries in large numbers. The regular holiday lull has hit New England but a good volume of business is pending and factories are working on good schedules. Industrial expansions in Canada have created a market for considerable shop equipment and sales of machinery are expected to increase early in the new year.

The Industrial Review

Progress of the machinery and machine tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New England

The lull in the machinery business during the past week is due entirely to the greater influence of small gift shopping demands and not to any business depression. Fundamental conditions are good in the business world in general, and, in fact, the machinery trade at the moment is in the best condition it has been in the past five or six years, according to the opinions of principal manufacturers in the New England territory.

The year comes to a close with business on the books in larger volume than in several years past. Special machinery builders find themselves with orders which will carry them well into the ensuing year and with contracts offering in substantial volume.

Buying has been at a standstill for ten days and inquiry mail is also reduced, but despite those conditions the machinery builders are prepared to place substantial orders for material for immediate use once the new year has turned.

New York

The last week of the year showed a volume of business in this market that was a pleasant surprise to many dealers and agents. Many orders that had been pending were closed during the week, and there was an appreciable increase in inquiries for equipment to be purchased immediately after 1927 appropriations are approved.

A large order for machine parts was placed in this market last week by the American Brown Boveri Co. The Delaware, Lackawana & Western R.R. issued an inquiry list for some twenty-five tools to be used in its various car repair shops. The New York Central, the Norfolk & Western and the Monongahela railroads made purchases of machines that had been quoted on old inquiries. The New York Rapid Transit Ry. purchased a large lathe for its local shops.

Several fair sized orders were placed by industrials, a few of which were: Crocker-Wheeler Electric Co., a lathe; Chateau Gay Ore and Iron Co., 3 drilling machines; the Coler Co., four 16-in. lathes; Dodge Bros., a jig borer; and Jones & Lamson, a thread miller.

The month of December compared favorably with other average months of the year and helped to bring the twelve-month total to a satisfactory level.

Canada

Business in the machinery and machine tool field has slackened off somewhat during the last couple of weeks, but this condition is not expected to last long as production schedules call for considerable activity with the turn of the year.

One of the most important of recent announcements is that a large railway construction program is in sight. The Canadian National Ry. is understood to be drawing up plans for a line into the Peace River district and the Canadian Pacific Ry. has several extensions in western Canada in view. It is altogether likely a start will be made on these projects during the coming summer.

Taking the metal working industry as a whole, the outlook for the first quarter of the new year is exceptionally bright. The Alberta Rolling Mills Co. reports a volume of work that will carry the company well into the new year. The Maple Leaf Steel Mills at Edmonton, Alberta, are getting under way, and have a considerable program of expansion. Eastern mills and engineering shops are in good position, some, in fact, being heavily booked on pulp and paper equipment account.

Prospects for the Sydney steel industry continue to brighten. It is reported that the steel mills will go on double shift during the first week in January, for the first time in several years. Just recently an order was received by Besco for 15,000 tons of steel rails for the Newfoundland government lines. In addition to orders now actually being rolled, Besco has at least 40,000 tons of rail orders on its books, or enough to keep the Sydney plant working well into next spring.

Cincinnati

Although a slightly-reduced number of orders were booked in the past week. Cincinnati machine tool manufacturers and selling agents report that the volume of sales was satisfactory, considering the fact that it is so near the end of the year. The lull was not as much as was expected and the market proved to be more active than in the corresponding period of last year.

The week's business consisted principally of orders for single tools and replacements, coming from all claasses of machine tool users. These were well scattered over the country and the purchases were well diversified as to sizes and types of tools.

Manufacturers of automobiles made a few scattered purchases and some were made by makers of accessories. Railroads sent in a few single orders, and it is thought that more buying from lists now on hand will follow early in the coming year. Several small orders were received from concerns in the electrical field and some came from industrial users and general machinists.

Considering the season of the year, it is stated, a large and very encouraging number of inquiries came in. These are said to indicate that at least for the present the market will be confined largely to replacements and single tools, as it has been through the present year. However, the aggregate of this business is expected to be large enough to keep sales up to a satisfactory level.

Chicago

The closing days of 1926 find the machine tool industry without change in the way of market conditions from that of the last two weeks. Little business is being done by dealers, who logically regard the present situation as one to be expected during the holiday season. Orders are being booked here and there for tools needed for emergencies or for replacement purposes, but such business as is being done is comparatively light. There is no sense of depression among the trade, however.

Inquiries for tools to be bought in the early months of 1927 encourage machinery men to believe that there will be considerable activity when stock taking is finished and the preparation of next year's budgets engages the attention of heads of departments. It is expected that railroad interests will be among the principal factors in the market for the first three months of the coming year, with the automotive industry following closely as production in this line increases. Agricultural implement manufacturers having bought freely for plant equipment needs during the last few months, it is not expected they will be in the market for new tools to any considerable extent until 1927 is fairly well advanced.

Inquiries among the larger machine tool houses with respect to next year's business develops a diversity of outlook.

Indianapolis

Little improvement was shown here during the last two weeks in the machinery and machine tool trade. This was to be expected, however, due to seasonal influences. However, there is an undercurrent of optimism expressed by the trade, due likely to a large number of inquiries.

During the last half of December, there appeared to be some increase in actual demand for heavy-duty lathes, but on the whole the situation is somewhat spotted. Indications now point to a large sale to the automobile factories immediately after the inventory period. With the Indianapolis plants, plans have been completed for immediate production on a large scale of new models, which are to be shown publicly for the first time at the New York show. The same is true at South Bend, Auburn and other centers in Indiana.

Inquiries would show that the railroads are planning the resumption of repair work after the first of the year. A big volume of inquiries is being received concerning small grinding machines and garage equipment. The last two weeks has seen some cautiousness in the purchase of coal mining machinery. Operators are becoming concerned over. decreasing exports to England and are governing their purchases accordingly.

A big volume of inquiry is being received from furniture factories and automobile body plants, where it is said the outlook is brighter than it has been for years. Some inquiries also are being received for construction machinery, but this market is not expected to develop until later.

Detroit

Sales of machinery and machine tools in Detroit and other industrial centers in southeastern Michigan are practically at a standstill until after the first of the year. What little buying there is consists chiefly of single tools for replacements, and even this class of purchase has fallen off considerably. Only in cases of dire necessity are purchases being made by the automobile factories.

With the close of the inventory period which comes at this season of the year, buying is expected to become quite active. Used tools are apparently having their day just at present for a number of dealers in this class of equipment have reported sales of not merely single machines but of several. List of new equipment are in the hands of the several machine tool dealers and within the next two weeks a break in the market for the better is expected.

This is especially true, it appears, among Detroit's automobile body factories. The demands which will be placed upon them by automobile manufacturers who look to 1927 as the year when various types of body styles will be more in demand than ever have caused the engineering department of the body plants to order many changes in equipment.

The few sales of such standard equipment as milling machines, grinders, lathes and borers as have been reported during the past few days have occurred at the Packard, Cadillac and Dodge plants.

Nation Is Making Economic Progress As 1926 Shows Highest Production

Country should recognize needs of agriculture

By Herbert Hoover
Secretary of Commerce

A reply to requests for opinion on the New Year's economic prospects can only be based on the economic currents already born of the old year. New and unknown currents will enter in the new year, so there is no such thing as assured economic prophecy.

No one will deny that 1926 has shown the highest total production and consumption of industrial commodities of any year in the history of the United States. Except in the textile industry and parts of the coal industry, it has been a year of high degree of employment, which has been accompanied by the highest peak in real wages, because wage income for the country as a whole has slightly increased and cost of living slightly decreased during the year. Manufacturing, the service industries, and commerce generally, have continued to improve their methods, to reduce costs, and to improve services. In aggregate each industry appears to show substantial profits except the textile and some parts of the coal industry. While there has been a slackening in production and demand for several staple lines during the past few weeks, we enter the new year with no consequential over-stock of manufactured goods.

Much Capital Available

With the largest volume of construction during the past year ever known there may prove to be some construction in advance of immediate needs, but slackening in this direction may be partially compensated by the assurance of a larger amount of public construction during the next year. Savings of the country have shown a steady increase and there is ample cheap capital available.

The lag of agricultural recovery has continued and has been accentuated by distressing crop failures in some localities. Cotton and some fruit crops beyond world demand have brought about prices below the cost of production of large areas of those commodities. There is a consequent lowered buying power in some agricultural sections.

Taking the foreign field as a whole, it shows continued progress toward balance of budgets; reduction of floating debt; greater stability in currency; and somewhat diminished unemployment. The most important exception has been the results of the British coal strike which left the world poorer by its interruption to the progress of that country; but this is now happily over. Russia shows some economic improvement; and China, due to international trade relations, still continues below normal. Each year sees progress in European political relations with fear less and less a dominating factor.

Combining all foreign and domestic tendencies with which we enter the New Year, while some of them are not so good as we could wish, others are most hopeful. To those who are interested in the movement of the business cycle, it is worth remarking that we have had no inflation in commodities as prices have decreased rather than increased during the year. Moreover, the elasticity of credit through the Federal Reserve System, the absence of undue stocks of commodities, the greatly enlarged information services of the country and wider understanding (and thus better common judgment and caution) are all protections against violent movements, such as we experienced in former times.

The nation is making economic progress. Some areas lag behind others, and discontent with the lag is an assurance of a lively sense of initiative and the best promise of remedy. Each individual tests the question of prosperity by his own setting and naturally applies his own test to his views of the economic state of the nation. If we use the more precise term "economic progress" we find we have per capita as the result of the year 1926 more and better homes, more electric lights and power, more transportation, more roads, more substantial buildings, more radios and more automobiles, more savings, more life insurance and more of a lot of things. We also have more educational facilities and more per capita circulation of newspapers and magazines than ever before.

Altogether we enter the New Year with a job in prospect for most everybody, with the whole nation better fed, better housed, and better clothed than any other nation. The large disappearance of poverty in the chronic sense should make us more sensible to the remedy of misfortune in the individual sense, and the high recovery of industry and commerce from the losses of the war should make us more sensible of the needs of agriculture.

Mail Planes Made Records with Air-Cooled Engines

American aircraft powered with American air-cooled engines in commercial operation in the United States and Canada flew 1,774,268.8 miles in 1926, or the equivalent of seventy-one times around the earth at the equator, according to a report by Charles L. Lawrence, president of the Wright Aeronautical Corporation, of Paterson, N. J. This report was compiled from detailed information received from thirty-three commercial aircraft operators using Wright "Whirlwind" 200-hp. air-cooled engines in eighteen different types of new commercial planes.

On all these flights there were only three forced landings due to failure of an engine part. No injury or fatality was caused by these forced landings.

According to Mr. Lawrence, nine out of the twelve air mail contractors of the United States are using Wright engines in some or all of their planes. Thirty-three commercial aircraft operators used 104 Wright engines at an average of 7.03 miles per gallon of gasoline. Per engine hour the average consumption is 11.5 gallons and the oil consumption averages three pints per hour. The eighteen types of airplanes mentioned in the report made an average speed of 90 miles an hour during the year.

According to the report received from the Varney Air Mail Service in June, 1926, that company replaced water-cooled engines with Wright air-cooled engines. Since June these seven engines have flown 189,326 miles with but $78 representing the cost of engine parts on their 520-mile route across the Rocky Mountains from Salt Lake City, Utah, to the State of Washington. This shows approximately $11 as the cost of engine repair parts for each 27,047 miles flown. Three of these engines gave over 300 hours in actual flying service in a period of less than five months.

Mechanics' Lien Law Ready for Approval

The first tentative draft of the proposed "Uniform Mechanics' Lien Act" has been finished and has been sent for review to organizations representing the principal interested groups and to a limited number of qualified individuals. When the committee has acted on their comments and suggestions, it is hoped that there will be a substantial agreement on general principles and that the act will represent the view of the various groups as well as they may be reasonably harmonized.

For several years there has been discontent with the mechanics' lien legislation in a number of states, and with the lack of uniformity among the acts of the forty-eight states and other territorial jurisdictions of the nation. Many leading men connected with the construction industries, and owners of buildings believed that a thorough consideration of lien law provisions should be made by an impartially constituted body. The National Association of Builders' Exchanges formally asked for the co-operation of the Department of Commerce, and several other national organizations endorsed the proposal. Secretary Hoover accordingly appointed a committee to undertake the drafting of an act and the department has rendered other assistance in the completion of this work.

A.S.S.T. Recommendation for Die Blocks

The sub-committee for the heat-treatment of tool steel of the American Society for Steel Treating has just issued to the membership of that body a tentative recommended practice for the heat-treatment of plain carbon and alloy steel die blocks. The full text of the recommendations is contained in fourteen sheets of the size to fit the regular *A.S.S.T. Handbook*. The report was made by J. E. Donnellan, secretary of the committee.

Business Items

The No Klank Chain Co., Providence, R. I., has incorporated to manufacture automobile chains of special type. The incorporators are: J. Donald Pryor, 260 West Exchange St., Providence; L. W. Jones and Eugene S. Graves.

The Otis Elevator Co., of New York, announced the payment of a stock dividend of 25 per cent on the common stock of the concern. The regular quarterly dividend on common and preferred stock was also declared.

Contract has been awarded for the construction of a roundhouse, machine shop and office building for the Louisville & Nashville R.R., at Evansville, Ind. The building will be of brick, concrete and steel and will be modern in every respect.

The Black & Decker Manufacturing Co., of Towson, Md., has disposed of an issue of $1,250,000 ten-year sinking fund debentures through a New York brokerage firm. These funds will be used to provide additional working capital for expansion of the production activities of the company.

The announcement is made that M. S. Siebert has disposed of his interest in the Seibert-Milburn Co., 141 North Front St., Columbus, Ohio, dealers in machinery, and specializing in construction and industrial equipment, to C. G. Milburn, who will continue the business under the name of the Milburn Machinery Co.

The Buffalo Forge Co., and the Buffalo Steam Pump Co., of Buffalo, announce the appointment of W. S. Koithan and R. W. Pryor, Jr., as joint managers of the Philadelphia office of the companies. This office is located in the Land Title Bldg. Mr. Koithan and Mr. Pryor are also managers of the New York offices of these companies.

The Planet Manufacturing Co., Westfield, Mass., manufacturer of lawn swings, collapsible pails and electric washing machines, has been purchased by Henry M. Van Deusen, president of the Van Deusen Whip Co., of Westfield. The Planet company was previously headed by Robert Gowdy and managed by Charles A. Hickson.

The New York, New Haven & Hartford Railroad Co.'s reconstructed repair shops at East Hartford, Conn., will be ready for occupancy in January. Machinery equipment costing $125,000 is now being installed. Employment will be given to 340 men, of whom twenty-five will be first class machinists. New equipment includes machinery for testing brakes.

The Torrington Manufacturing Co., Torrington, Conn., manufacturers of machinery, has acquired the machine business of the Blake & Johnson Co., of Waterbury. The deal includes only the machine division at 173 North Elm St., which will be moved to Torrington early in 1927. Wadsworth Doster, formerly with the Torrington Manufacturing Co., and at present with the Blake & Johnson Co., will be placed in charge of sales of the new business.

The Davis Arms Corporation, of Norwich, Conn., manufacturers of shotguns, was sold recently at public auction. Frank D. Warner, president of the company, purchased the property. The Davis-Warner Arms Corporation filed papers of incorporation immediately after and will continue the business. The company will manufacture firearms, machinery and ammunition. The following incorporators are listed: Franklin B. Warner, Charles Chester Warner and Marvin Warner.

Increased manufacturing facilities for the new model Marmon automobile are to be put into effect immediately, according to G. M. Williams, president of the Marmon Motor Car Co., of Indianapolis. For its immediate needs the company has available the factory buildings formerly occupied by the milling machine business recently sold to the Allis-Chalmers Co. Removal of the equipment of the milling machinery plant to the home factory of the purchasers at Milwaukee has been completed, giving the Marmon company sufficient factory space to greatly augment the capacity of Plant 3, where the "Little Marman" is now being built.

The plant of R. D. Eaglesfield, Inc., Brazil, Ind., manufacturer of wood-working machinery, has been sold in bankrupt court at Indianapolis to the Marion Machine, Foundry and Supply Co., of Marion, Ind. The officials of the Marion company immediately organized a new company to be known as the Indiana Machine and Foundry Co. The new company began immediately putting the plant in condition for operation. About $25,000 will be spent to install an iron and brass foundry. R. D. Eaglesfield, who will remain with the new company, is the owner of patents on many special wood-working machines used in auto body and furniture factories.

Personals

E. G. Meckstroth has been appointed general manager of the Morris Machine Tool Co., of Cincinnati. He was formerly superintendent.

Ambrose Swasey, president of the Warner & Swasey Co., of Cleveland, celebrated his eightieth birthday at his home in that city last week.

Charles T. Bush, general manager of the C. A. Strelinger Co., of Detroit, has been re-elected president of the Detroit Automobile Club.

J. I. Burgess has been appointed sales manager for the National Pipe Products Co., of Rochester, Pa. He was formerly Ohio sales representative for the National Acme Co.

Stewart Scrimshaw, director of industrial relations for the Kearney & Trecker Corporation, of Milwaukee, has been honored by the University of Wisconsin with the degree of Doctor of Philosophy.

R. F. Sterling, recently appointed European sales manager for the National Automatic Tool Co., of Richmond, Ind., sailed for France last week to take up his new duties. He will make his headquarters in Paris.

A. P. James has been appointed executive in charge of the Pacific division offices of the Bunting Brass and Bronze Co. Mr. James has been sales manager of the automotive replacement department in the main sales offices at Toledo, Ohio.

George M. Bakewell is the new head of the export department of the Bunting Brass and Bronze Co., of Toledo, Ohio. Mr. Bakewell was formerly overseas representative of the Champion Spark Plug Co. Mr. Bakewell will make his headquarters at the export offices of the company, 254 West 54th St., New York City.

Fredbrick M. Feiker has been appointed managing director of the Associated Business Papers, Inc. Mr. Feiker is well known in the industrial and publishing world, having been for fifteen years an editor and publisher, a year and a half in the Department of Commerce, and lately connected with trade association work.

A C. Pletz, who has been general manager of the Morris Machine Tool Co., of Cincinnati, for the past 12 years, has resigned to become manager of the miscellaneous tool department of the Niles Tool Works, of Hamilton, Ohio. Mr. Pletz will be located at Hamilton and will have charge of the sale of all tools sold by the company that are not manufactured in its own shops.

Obituaries

W. R. Scott, president of the Southern Pacific Lines in Texas and Louisiana, died at Los Angeles, Calif., on Dec. 20. He was sixty years old and had been engaged in railroad work all his life.

A. H. Hitchcock, publisher of trade journals, died on Dec. 11 at Mountain Lakes, N. J., aged 70. In 1899 he established the *Machine List*, and in 1906 *Hitchcock's Machine Tool Blue Book*. He came to Chicago in 1875, where he started in trade journalism.

Charles F. Brooker, chairman of the board of the American Brass Co., of Ansonia, Conn., died at Dayton Beach, Fla., on Dec. 20. He was 79 years old. Mr. Brooker was an outstanding figure in the copper and brass industry and was instrumental in bringing about the merger of several competing companies into the American company, of which he was the active head for many years.

Calendar of Local Meetings

National Association of Cost Accountants

Boston Chapter. Jan. 20. "Standard Costs," by Eric A. Camman.

Buffalo Chapter. Jan. 27. "Co-ordinating the Factory and General Accounts to Insure Prompt Monthly Closing," by John E. Horn.

Chicago Chapter. Jan. 20. "Fixing Material Standards as a Basis for Standard Costs," by W. L. Churchill.

Cleveland Chapter. Jan. 19. "Distribution Costs," by F. L. Sweetser.

Detroit Chapter. Jan. 27. "Standard Cost Accounting for Automobiles," by G. Charter Harrison.

Erie Chapter. Jan. 17. "Department Burden, Overhead and Selling and Administrative Cost," by C. H. Scovell.

Hawaii Chapter. Jan. 25. "Mercantile Accounting," by C. P. Benton.

Hartford Chaper. Jan. 18. "Debatable Subjects of Mutual Interest to Foremen, and Team Work between Foremen," by H. G. Crockett.

Kansas City Chapter. Jan. 17. "Where the Cost Accountant and Engineer Meet."

Los Angeles Chapter. Jan. 18. "Costs of Selling."

Milwaukee Chapter. Jan. 20. by F. H. Elwell.

Philadelphia Chapter. Jan. 21. "Building and Loan Association," by Edward P. Moxey.

Providence Chapter. Jan. 10. "Distribution Costs." by M. E. Abbot.

Rochester Chapter. Jan. 19. "The Business Outlook for 1927," by J. C. Howell.

St. Louis Chapter. Jan. 18. "Appraisals and Their Relation to Costs," by H. G. Baldwin.

San Francisco Chapter. Jan. 24. "Developments of Budgetary Control."

Scranton Chapter. Jan. 25. "Transportation and Tonnage Taxes," by P. A. Kennedy.

Springfield Chapter. Jan. 19. "Business Outlook for 1927," by Ray Vance.

Syracuse Chapter. Jan. 18. "Why Systems Fail," by Robert Anderson.

Twin Cities Chapter. Jan. 18. "How-We-Do-It in Department Stores," by W. A. Dillman.

Forthcoming Meetings

American Engineering Council. Annual meeting, Hotel Mayflower, Washington, D. C., Jan. 13 to 15. A. C. Oliphant, assistant secretary, 26 Jackson Place, Washington, D. C.

American Society for Steel Treating. Winter Sectional Meeting, Washington, D. C., Jan. 20 and 21, 1927. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual meeting, Detroit, Jan. 25 to Jan. 28. W. Delchamps, chairman, meetings and sections department, 29 West 39th St., New York.

The Weekly Price Guide

Rise and Fall of the Market

DEMAND is active and prices firm in railway material, steel plates, rails, lap-weld steel pipe and cast-iron pipe. The pig-iron market is slow with buying confined to small tonnages in the South and West; the North Atlantic states, however, show livelier interest in this basic material, which governs the price of machine-shop steel. Non-ferrous metals are quiet, with the possible exception of zinc. Tin is lower now than at any time since the latter part of September. Price declines also occurred during the week in babbitt, metal, scrap, foundry coke, and linseed oil.

(All prices as of Dec. 24)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.89
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	20.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	23.76
Virginia No. 2	28.19
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	24.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.76
Basic	20.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.25
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.30@2.40	3.50	3.25	3.89
No. 12	2.35@2.45	3.55	3.30	3.94
No. 14	2.40@2.50	3.60	3.35	3.99
No. 16	2.50@2.60	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.80@2.90	3.75	3.60	4.15
No. 22	2.95@3.05	3.90	3.75	4.30
No. 24	3.00@3.10	3.95	3.80	4.35
No. 26	3.10@3.20	4.05	3.90	4.45
No. 28	3.25@3.35	4.20	4.05	4.60
Galvanized				
No. 10	3.25	4.10	3.95	4.40
Nos. 12 to 14	3.35	4.20	4.05	4.50
No. 16	3.45	4.30	4.15	4.60
No. 18	3.60	4.45	4.30	4.75
No. 20	3.75	4.60	4.45	4.90
No. 22	3.80	4.65	4.50	4.95
No. 24	3.95	4.80	4.65	5.10
No. 26	4.20	5.05	4.90	5.35
No. 28	4.45	5.30	5.15	5.60

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — B.W.G. and Decimal	Fractions	Outside Diameter in Inches — ⅛	¼	⅜	½	1	1½	1¼
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
065"	16	.19	.20	.21	.22	.23	.25	.27
083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅛, 8.35c.; ¼, 7.85c.; ⅛ to ¼, 7.35c. per lb. *Flat, ⅛@¼-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.87½
Tin, 5-ton lots, New York			69.25
Lead (up to carlots) E. St. Louis	7.67½	New York	8.50
Zinc (up to carlots) E. St. Louis	7.05	New York	8.00

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	15.50	17.50	15.00
Copper sheets, base	22.25	22.00	22.25
Copper wire, base	19.12½	19.25	15.75
Copper bars, base	21.87½	21.87½	21.87½
Copper tubing, base	24.25	24.25	24.25
Brass sheets, high, base	18.62½	18.62½	20.12½
Brass tubing, high, base	23.50	23.50	23.00
Brass rods, high, base	16.37½	16.37½	16.37½
Brass wire, high, base	19.12½	18.87½	19.12½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	13.00	12.80	12.01
Solder (½ and ½), (case lots)	42.00	44.50	38½@42½
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			88.00
Commercial genuine, intermediate grade			62.00
Anti-friction metal, general service			32.50
No. 4 babbitt (f.o.b.)			13.50
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35.00 Electrolytic 39.00 Shot			36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.62½@11.87½	11.00	10.50@11.00
Copper, heavy, and wire	10.87½@11.37½	11.25	10.00@10.50
Copper, light, and bottoms	9.50 @10.00	9.50	8.75@ 9.25
Heavy lead	6.50 @ 7.00	6.50	6.00@ 6.50
Tea lead	4.50 @ 5.00	4.50	4.75@ 5.25
Brass, heavy, yellow	7.00 @ 7.25	7.25	6.50@ 7.00
Brass, heavy, red	9.25 @ 9.75	9.25	8.50@ 9.00
Brass, light	5.50 @ 5.75	6.00	6.00@ 6.50
No. 1 yellow rod turnings	7.75 @ 8.25	7.50	7.25@ 7.75
Zinc	4.25 @ 4.50	4.00	3.50@ 4.00

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	6.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.18	$0.15@0.20
Cotton waste, colored, per lb.	.10@ .14	.13½	.12@.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.15
Sal soda, per 175 lb. keg	2.80	2.75	2.75
Roll sulphur, per lb	.04	.03½	.04
Linseed oil, per 7½-lb. gal., 5 bbl. lots	.81	.98	.84
Lard cutting oil, 25% lard, per gal.	55	50	48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	35	35	29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb	.04	.04	.04
Brass rods	per lb	.1637½	.1662½	.1687½
Solder (½ and ½)	per lb	.42	.4275	.4025
Cotton waste	per lb	.13@17½	.13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb	7.00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal	.55	.55	.55
Machine oil	per gal	.35	.35	.35
Belting, leather, medium	off list	40–5%	40–5%	40–5%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.40	$5.84	$5.13
Emery paper	10.71	11.00	10.71
Emery cloth	27.84	31.12	27.84
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.45	1.32
Cloth	3.10	3.50	3.05
Fire clay, per 100 lb. bag		.75	75
Coke, prompt furnace, per net ton	Connellsville,		3.50@3.75
Coke, prompt foundry, per net ton	Connellsville,		4.50@5.50
White lead, dry or in oil,	100 lb. kegs	New York,	15.25
Red lead, dry,	100 lb. kegs	New York,	15.25
Red lead, in oil,	100 lb. kegs	New York,	16.75

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1½ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{7}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for $\frac{7}{16}$-in and smaller and 65% for ½-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ¾-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in, 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ⅜-in., $7.00* per 100 lb. at New York warehouses; ½-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Mass., Boston—P. O. Box 1681—back geared bench lathe equipped.

Mass., Brockton — D. W. Mullen, 90 Boylston St.—miscellaneous tools and equipment for repair and service garage at 159 Main St. Estimated cost $40,000.

Mass., Newton (Boston P. O)—P. A. Murry & Co., 210 Washington St.—miscellaneous tools and equipment for repair garage and service station on Washington St. Estimated cost $40,000.

Mass., Somerville—Somerville Machinery & Foundry Co., 14 Kent St.—complete machinery and equipment for factory.

Mo., St. Louis — Century Electric Co., 1806 Pine St.—large crane and auxiliary equipment for proposed 1 story, 109 x 124 ft. box factory at Pint and 20th St.

N. Y., Brooklyn — Mutual Electric & Hardware Mfg. Co., 18 Verandah Pl.—one stiles punch, 36 in., throat and one pattern lathe.

N. Y., New York—L. Shulman & Son, 104 Canal St.—Pels-Schatz combination punch and shear.

Okla., San Springs—A. G. Heggen—complete machinery for proposed steel fabricating and plate rolling mill. Estimated cost $1,000,000.

Tex., Amarillo—Amarillo Furniture Co., S. H. Wright, Pres., 409 Taylor St., will receive bids after Jan. 5 for machinery and equipment including welding machine, drill press, biot cutter, 2 lathes, etc., for proposed 4 story, 100 x 135 ft. factory. Estimated cost $150,000.

Tex., Lufkin—Lufkin Foundry & Machine Co.—machinery and equipment for proposed addition to plant. Estimated cost $15,000.

Tex., Weslaco—Weslaco Auto Co.—machinery and equipment including 2 drill presses, 3 lathes, bolt cutter, hydraulic machinery for greasing, etc. for proposed 2 story garage. Estimated cost $50,000.

Wis., Hayward—E. J. Collett, Highway Comr.—lathe, drill press and grinder for repairing road equipment.

Wis., Milwaukee—Valerius Refrigeration Corp., 458 Jefferson St., T. L. Valerius, Purch. Agt.—2 punch presses and 2 drill presses.

Ont., Morrisburg—Canadian Electric Device Co., Ltd.—complete equipment for the manufacture of small electric devices to replace fire loss. Estimated cost $150,000.

N. Z., Wellington—New Zealand Government Railways, will receive bids until Apr. 18 for 55 overhead electric cranes, from 2 to 200 ton capacity and 39 ft. 3 in. to 80 ft. span, 3 electric traversers, 120 jibb cranes, 20 electric capstans, 4 electric mobile cranes, etc.

Opportunities for Future Business

Calif., Los Angeles — Chapman Bros., c/o R. H. Orr, Archt., Corporation Bldg., will soon award contract for the construction of a 5 story, 90 x 275 ft. garage at Sixth St. and Mariposa Ave.

Calif., Richmond — Ford Motor Car Co., Highland Park, Mich., is having plans prepared for the construction of an assembling plant here. Estimated cost $1,000,000. Private plans. Noted Oct. 14.

Conn., Hartford—J. P. Nielson & Sons, 76 Maple Ave., will build a 2 story, 95 x 250 ft. sales and service station on Washington St. Noted Jun. 10.

Ga., Atlanta—Georgia Railway & Power Co., operated by Georgia Power Co., is having plans prepared for the construction of a 1 story, repair and service garage. Estimated cost including equipment $105,000.

Ill., Chicago—S. D. and W. Jones, 133 born St., Archts., are receiving bids for the construction of a garage for F. R. Bennett, 1513 Morse Ave. Estimated cost $60,000.

Ill., Chicago—S. D. Jones, W. Jones, 133 West Washington St., awarded contract for the construction of a 1 story, 99 x 181 ft. garage at 7141 Exchange Ave. Estimated cost $75,000.

Ill., Chicago — Ohrenstein & Hild, 222 East Ontario St., Archts., are receiving bids for the construction of a 2 story, 50 x 120 ft. machine shop and office for Kettler Elliott Co., 3121 South California Ave. Estimated cost $100,000. C. R. Miller in charge.

Ill., Galesburg — Winslow Boiler & Engineering Co., Chamberlain and Knoxville Sts., plans the construction of a 1 story, 50 x 150 ft. factory. Estimated cost $60,000. Private plans.

Ind., Elkhart — Marshall Electric Co., 3225 Locust St., St. Louis, Mo., awarded contract for the construction of a 1 story, 50 x 100 ft. factory here. Estimated cost $20,000.

Md., Baltimore — Bartlett Hayward Co., 200 Scott St., manufacturers of gas plant equipment, plate products and other machinery, awarded contract for the construction of a 2 story, 50 x 56 ft. and 26 x 30 ft. additions to plant.

Mass., Arlington (Boston P. O.)—J. Loud, c/o Park Boulevard Garage Co., 20 Massachusetts Ave., is having plans prepared for the construction of a 1 story, 55 x 100 ft. addition to repair and service garage. Estimated cost $40,000. H. L. Kennedy, 80 Boylston St., Boston, Archt.

Mass., Boston—E. Sorrentini, 82 Porter St., East Boston, is having plans prepared for the construction of a 1 story, 50 x 100 ft. repair and service garage at 152-154 Paris St., here. Estimated cost $40,000. B. C. Gallo & Co., 42 Maverick Sq., East Boston, Archts.

Mass., Roxbury (Boston P. O.)—S. Rudnick, 333 Washington St., Boston, is receiving bids for the construction of a 1 story, 85 x 180 ft. repair and service garage on Clifford St., here. Estimated cost $75,000. Eisenberg & Feer, 46 Cornhill, Boston, Archts.

Mass., South Boston (Boston P. O.)—Dahlquist Mfg. Co., 36 West 3rd St., coppersmith, awarded contract for the construction of a 2 story addition to plant.

Mass., Taunton—H. O. Rogers Silver Co., plans to rebuild plant partially destroyed by fire. Estimated cost $50,000. Architect not selected.

Mass., Willimansett (Holyoke P. O.)—The C. F. Church Mfg. Co., Holyoke, manufacturers of plumbers' supplies, awarded contract for the construction of a 40 x 170 and 45 x 50 ft. addition to plant here.

Mich., Kalamazoo—Kalamazoo Stove Co., A. L. Blakeslee, Gen. Mgr., awarded contract for the construction of a 1 story addition to enameling building. Estimated cost including equipment $50,000.

Mo., Kansas City—W. A. Ross Construction Co., 1921 Broadway, will build a plant including garage, warehouse, etc., on 25th St. Estimated cost $135,000.

N. J., Bayonne—Safety Cable Co., Bergen Point, awarded contract for the construction of 3 unit plant. Estimated cost $250,000.

N. J., Fernwood (mail Trenton)—Duncan Mackenzie's Sons Co., Trenton, plans the construction of a 2 story, 60 x 200 ft. foundry here. Estimated cost $200,000.

N. J., Newark—Edgecomb Steel Co., 11th and Cambria Sts., Philadelphia, Pa., plans the construction of a warehouse on Frelinghuysen Ave., here. Estimated cost $100,000.

O., Akron — The Akron Equipment Co., Exchange and Annadale Sts., awarded contract for the construction of a 2 story, 63 x 65 ft. factory. Estimated cost $30,000.

O., Cincinnati — Goldsmith Metal Lath Co., Third and Eggleston St., awarded contract for the construction of a 1 story, 80 x 300 ft. factory on Orient St. Estimated cost $140,000. Noted Oct. 14.

O., Cincinnati—Schott Auto Co., 2414 Gilbert Ave., plans the construction of a 1 story, 75 x 175 ft. sales and service station. Estimated cost $165,000. Rendigs, Panzer & Martin, 609 Southern Ohio Block, Archts. Auto Sales Co., lessee.

O., Cleveland—Gogan Machine & Supply Co., 1630 Collamer Ave., awarded contract for the construction of a 1 story, 24 x 100 ft. factory at 5442 Homer St. Estimated cost $40,000.

O., Cleveland — Grabler Mfg. Co., L. Rosenfeld, Pres., 6565 Broadway, manufacturers of metal specialties, will receive bids until Jan. 2 for the construction of a 1 story addition to core foundry. Estimated cost $40,000. Christian, Schwarzenberg & Gaede, 1900 Euclid Bldg., Archts. and Engrs.

Okla., Sand Springs—A. G. Herrigene, 303 West 6th St., Tulsa, plans the construction of a steel plant here. Estimated cost $1,000,000. Private plans.

Pa., Cochranton — Nonpareil Mfg. Co., manufacturers of agricultural implements and machinery, plans to rebuild portion of plant recently destroyed by fire. Estimated cost including equipment $45,000.

Pa., Darby — Roberts Filter Mfg. Co., manufacturers of water filters, plans the construction of a new plant to replace fire loss.

Pa., Philadelphia — Philadelphia Motor Service Co., awarded contract for the construction of a 4 story sales and service station on Columbia St. Estimated cost $300,000.

Pa., Philadelphia—Stanley Construction Co., Lincoln Bldg., will soon receive bids for the construction of a 1 story, 80 x 240 ft. garage at Leiper and Frankford Sts. J. E. Fieldstein, Otis Bldg., Archt.

Pa., York—H. L. Neuman Co., c/o E. Neuman, 30 South Mulberry St., is having plans prepared for the construction of a 3 story, 70 x 140 ft. addition to repair shop and storage building at King Mill Rd. Estimated cost $60,000. Paul Hostettler Co., Inc., Summer St., Engr.

R. I., Providence—J. Marcus, 184 North Main St., awarded contract for the construction of a 1 story warehouse, garage and repair shop on Otis St. Estimated cost $50,000. Noted Dec. 9.

Tex., San Antonio—Central Improvement & Investment Co., Third St. and Broadway, awarded contract for the construction of a 3 story, 80 x 140 ft. garage and sales and service building at 10th St. and Broadway.

Wis., Milwaukee—G. W. Browne, Inc., 146 Broadway, will soon award contract for the construction of a 1 and 3 story, 100 x 120 ft. garage on Grand Ave. Estimated cost $100,000 to $150,000. P. Marzillier, 144 Oneida St., Archt.

Wis., Wisconsin Rapids — Standard Oil Co., 2 Copeland Ave., La Crosse, is having plans prepared for the construction of a 2 story warehouse and garage here. Estimated cost $100,000. R. N. Allen, c/o owner, Archt. and Engr.

Ont., Toronto—Canadian Pacific Ry. Co., Montreal, J. M. R. Fairbairn, Ch. Engr., plans the construction of new coach yards including 70 x 120 ft. machine shop, wheel and lathe building, etc., here, Estimated cost $3,000,000.

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American Machinist

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A Prosperous New Year To You!

1926 has brought to the American metal working industries a full measure of prosperity. It is the earnest hope of the "American Machinist" that for you 1926 will prove to have been not the pinnacle of business but a step upward to better times.

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Still More Reasons Why New Machine Tools Replace the Old

As Told By Leading Users

To Increase Profits Through Increased Output, by—

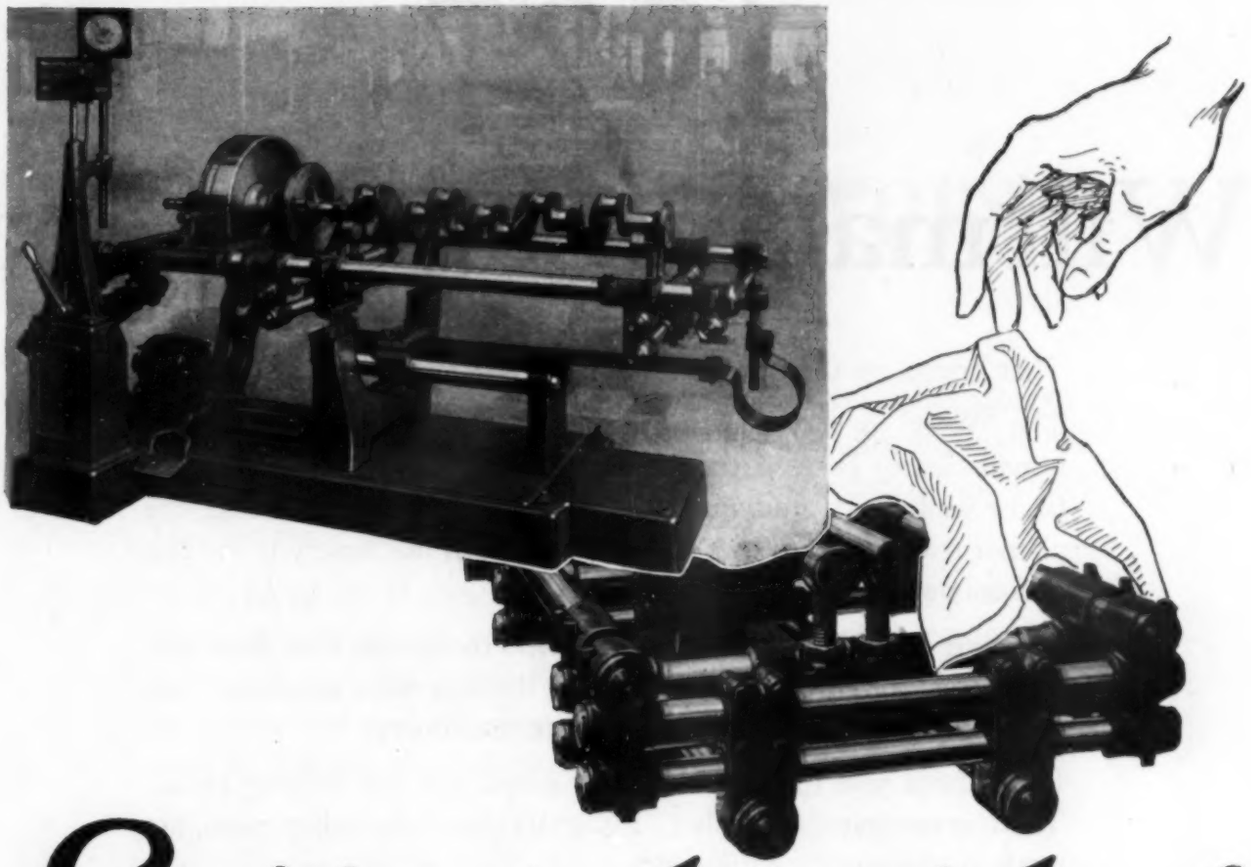
1. Using automatic controls
2. Using power rapid traverses
3. Taking faster cuts
4. Taking heavier cuts
5. Taking combination cuts at different stations
6. Taking plural cuts at the same station
7. Using station loading and unloading devices
8. Using larger and better fixtures
9. Using motor drives

Besides the savings in direct and indirect costs listed heretofore, the prominent production executives who wrote *American Machinist's* Series "Getting the Most Out of Your Machine Tool Dollar" have the above very good reasons for installing modern

Machine Tools—
The Master Tools of Industry

Modern Equipment
Cuts Costs

NATIONAL
MACHINE TOOL BUILDERS'
ASSOCIATION



Sensitive to the weight of a handkerchief ~ ~ ~

To test the sensitiveness of the Gisholt Precision Balancing Machine (which weighs more than a ton) a handkerchief was dropped on one end of one of these machines. The recording amplimeter showed a disturbance of 2½ divisions.

Not only does the Precision Balancing Machine record the most minute amount of unbalance, but it also clearly indicates where a correction should be made to remove the unbalance. It works with the exactness of a set of jeweler's scales and with the accuracy of the best "mike."

THE PRECISION BALANCING MACHINE

If you have balancing of any kind an investigation of the Gisholt Method of Balancing will prove to be very interesting to you and undoubtedly profitable.

Our Treatise "Dynamic Balancing Simplified" explains the Gisholt Method of Balancing and we will be glad to send you a copy at your request.

Gisholt Machine Co.

Madison, Wisconsin, U. S. A.

The PRECISION Balancing Machine

1927

Will make or break a good m

That brings up the question—Why?

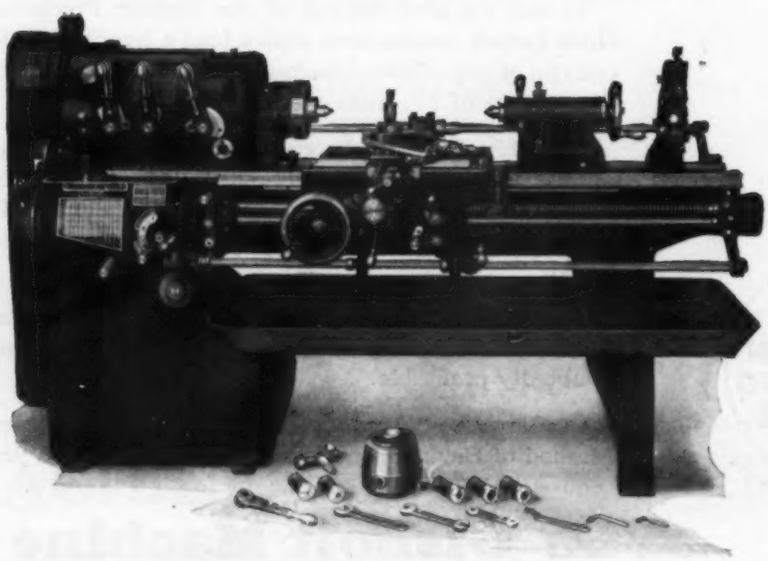
The "Why" is very plain to the man who looks ahead. To him it will clearly be seen that competition will gradually become a factor well worth studying. The more competition is studied, the plainer it will be seen that the use of modern machinery is the one and only solution to overcome it.

The year of 1927 will *make* the man who recognizes this. Similarly will it cast a veil of misfortune over the one who attempts "just another year's use" from old, obsolete machinery.

Look about you today. Note the shops that are forging ahead. Then investigate carefully. It's a 100 to 1 bet they now use modern time-saving equipment.

Send today for booklet on

The Lodge & Shipley Tool Room Lathe



14 in. Selective Head Lodge & Shipley Tool Room Lathe with Belted Motor Drive in Leg. Made in Sizes 12 in. to 20 in.

The Lodge & Shipley Machine Tool Co.

Cincinnati, Ohio

1927

many manufacturers

This year will be just what you make it.

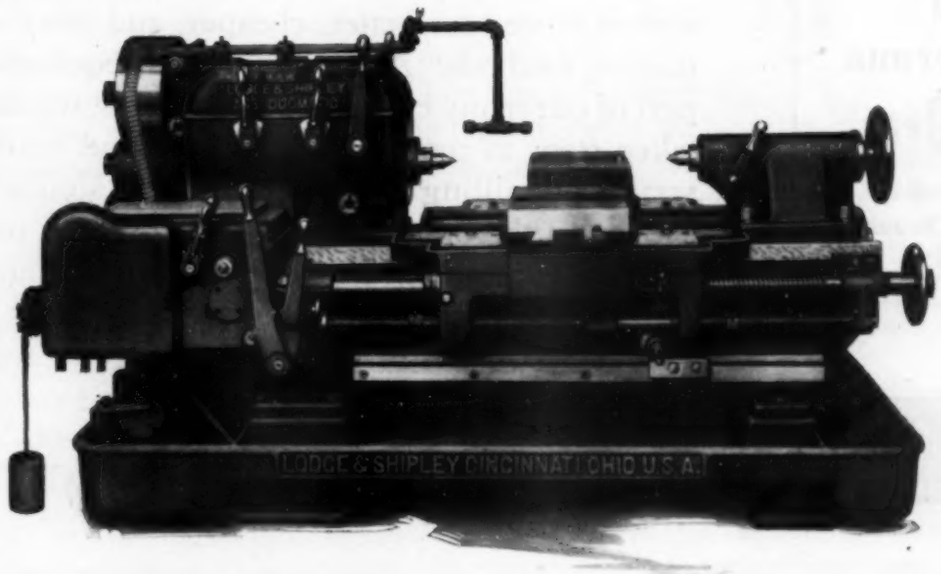
If you attempt to "save" money by failing to invest in modern equipment your complaint next December undoubtedly will be that you have actually lost money; that So and So took your business away because they are lucky, etc.

Not a bit of it! If some one takes business away from you during the next year it will be because they deserved it; because they foresaw just the thing you did not; namely, that competition would be keener and that the shop equipped to turn out work fast and with high limits of accuracy would be the one to get the business.

This is not just the verdict of a few, but the edict of many!

Send today for booklet on

The Lodge & Shipley DUOMATIC



The Lodge & Shipley Machine Tool Co.

Cincinnati, Ohio

1927 PLANS

A Happy and Prosperous New Year

Is Our Wish for Our Many Friends For 1927

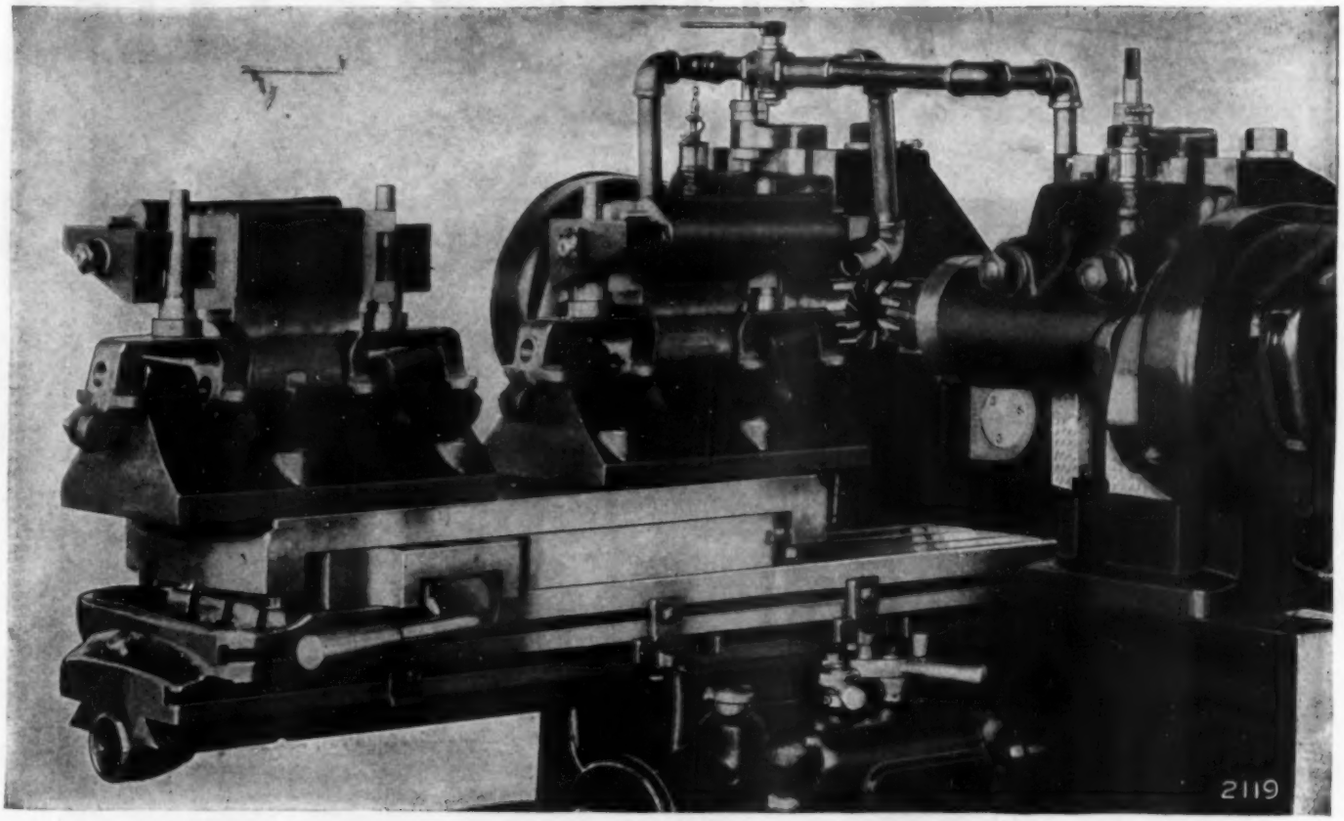
During 1926, as never before, industry has called upon our Service Department for new ideas on milling.

As we see it, 1927 is going to be a year of very satisfactory manufacturing volume, but a year which will bring with it a need for better, cheaper, and more productive milling methods. Anticipating this requirement on the part of our many customers and friends, we have already taken steps to render more prompt and more extensive service on milling methods. Problems similar to the one shown on the opposite page are solved by us daily and with no obligation. You are welcome to our ideas and our recommendations—which will be made personally by our Specialists in your plant (large or small) if you wish.

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI · OHIO · U·S·A·

CINCINNATI MILLERS



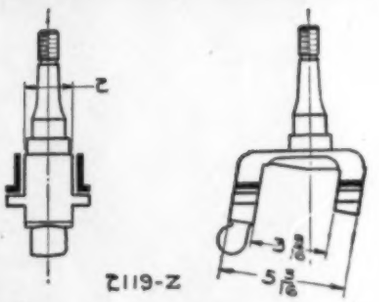
(Patented)

INTERMITTENT FEED CUTS TIME

You couldn't do this job so satisfactorily without a Duplex Miller. You need the patented intermittent feed of the Cincinnati 24-in. Duplex to do it rapidly. The operation consists of milling two lugs on each side of the fork. The automatic rapid traverse jumps the gap between the lugs and also between the pieces. The index base method permits loading one of the fixtures while milling on the other.

The long shank or stem makes it practically impossible to mill the lugs with side mills as they would be entirely too large in diameter. The job could, of course, be done on a Plain Automatic or a Knee Type machine, by laying it down and making two settings, one for each side. It didn't take long to discard both methods in favor of the 24-in. Automatic Duplex.

"Modern Equipment Cuts Cost"

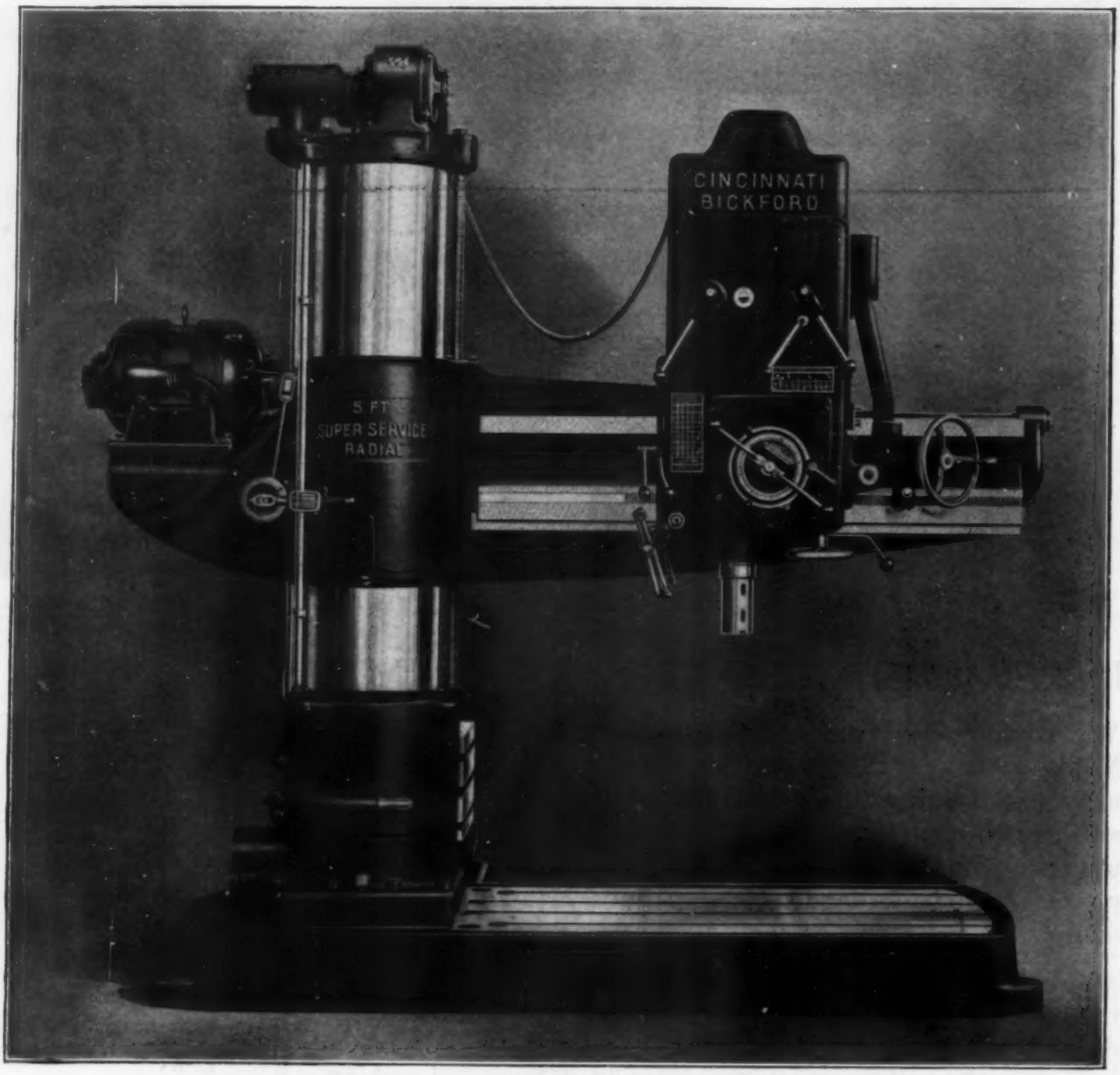


Part Name—Steering Knuckle.
Operation—Mill Brake Anchor Seat.
Material—1040 Steel Forging.
Stock Removed—3/32-in.
Cutters—2—2½-in. Dia. Shell End Mills, 1 R. H. and 1 L. H.
Feed—10.2-in.
Speed—88 R. P. M.
Time per Piece—1.55 Minutes.
Machine—24-in. Cincinnati Duplex Automatic.

The Right Machine for the Job

CINCINNATI MILLERS

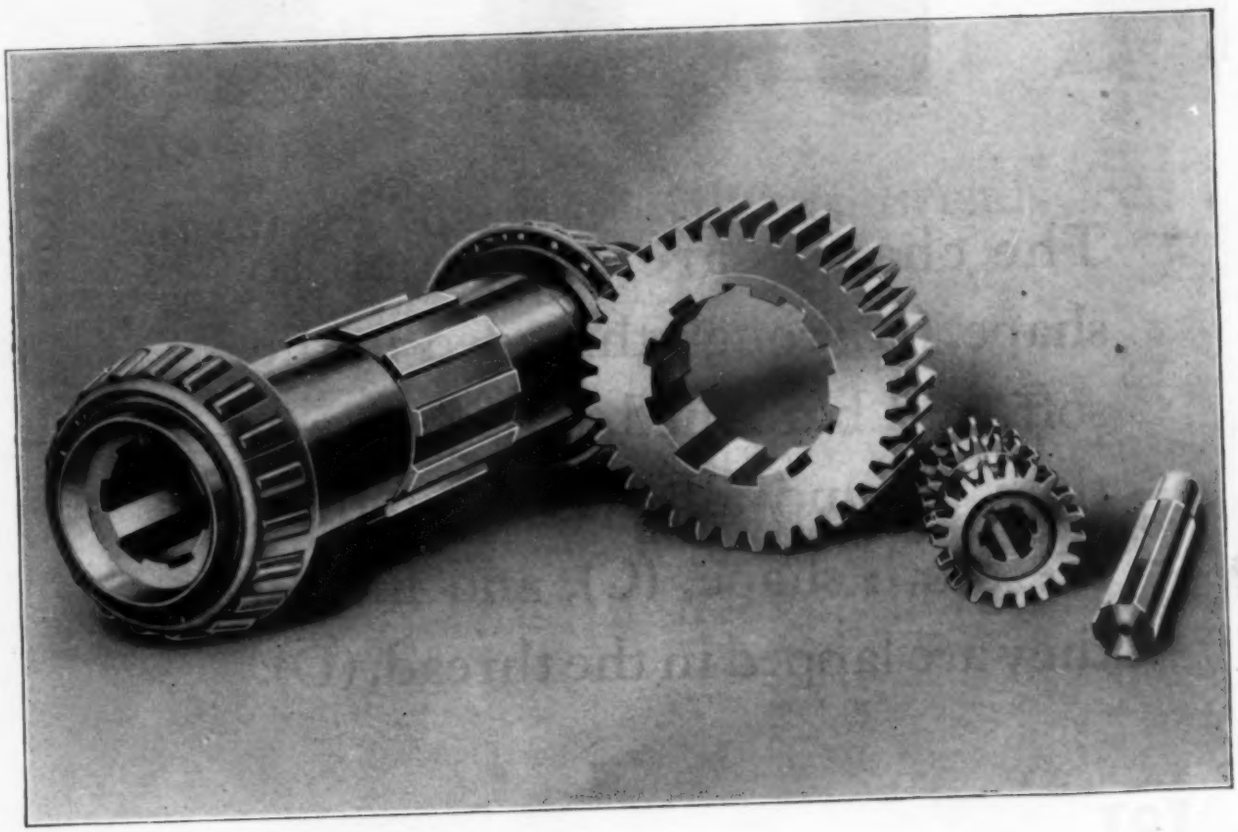
Longer life



The SUPER

THE CINCINNATI BICKFORD TOOL

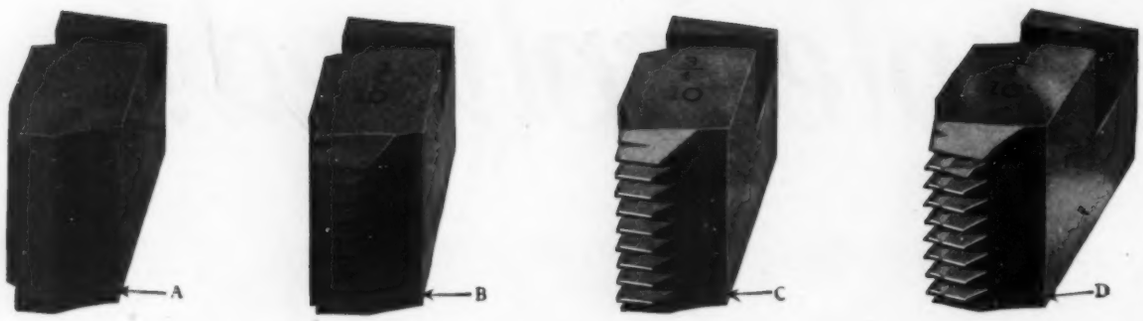
because . . . *every shaft is multiple splined!*



SERVICE *Radial*

COMPANY. OAKLEY. CINCINNATI. OHIO.

The Chasers are ground in



The chasers are machined to shape, (A); rough threaded in the soft, and hardened, (B); they are then ground all over, including the tooth shape, (C), and finally they are lapped in the thread, (D).

J&L
JONES & LAMSON

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Fay Automatic Lathe
Hartness Double Spindle Flat Turret Lathe

Springfield,

J&L
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and lapped the thread after hardening

What does this mean?

First:

It means that they will cut threads accurate in form, diameter *and lead.*

Second:

It means that high speed steel chasers, ground after hardening, will run at higher speeds than ever before, and last longer.

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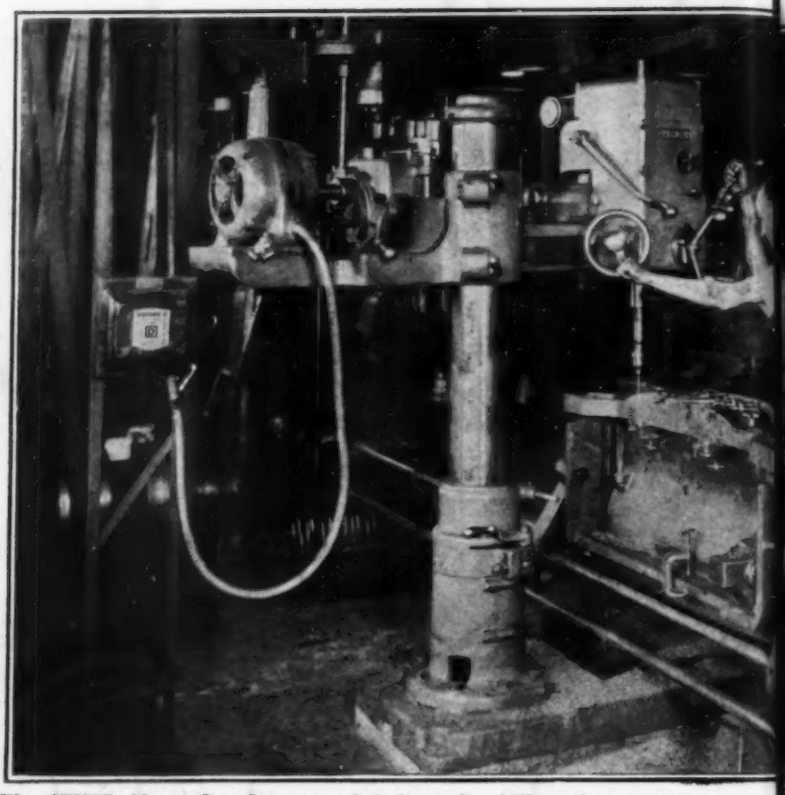

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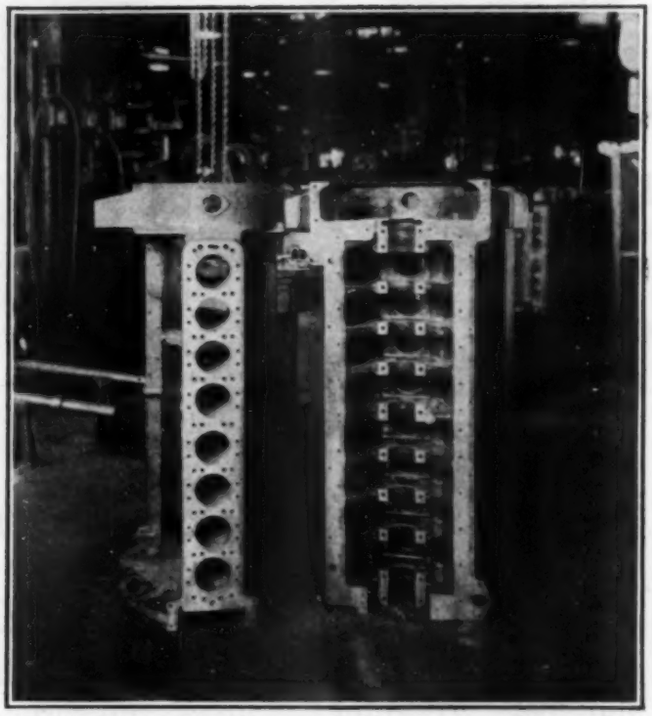


"Modern Equipment is Profit Assurance"

Mr. F. E. Moskovics, President of the Stutz Motor Car Company, says: "Almost invariably after showing the NEW STUTZ I am asked, 'How can you do it at the price?' In fact, some of the biggest men of the automotive industry have inquired if this automobile is priced sufficiently high."

The sum and substance of Mr. Moskovics' answer is quantity production and proper tools and equipment to insure low production costs.

"American" Sensitive Radials assist in making this quantity production profitable to the Stutz Motor Car Company and to all other companies in whose shops they are operating.

They can definitely help you in a similarly profitable way.

THE AMERICAN TOOL WORKS CO.—Cincinnati—U. S. A.

LATHES - - RADIALS - - SHAPERS

The Original Gear Shaper Cutter

Still Stands Pre-eminent in the Field of Accurate Gear Cutting

The Gear Shaper cutter originated by The Fellows Gear Shaper Company twenty-nine years ago is still pre-eminent in the field of accurate gear cutting.

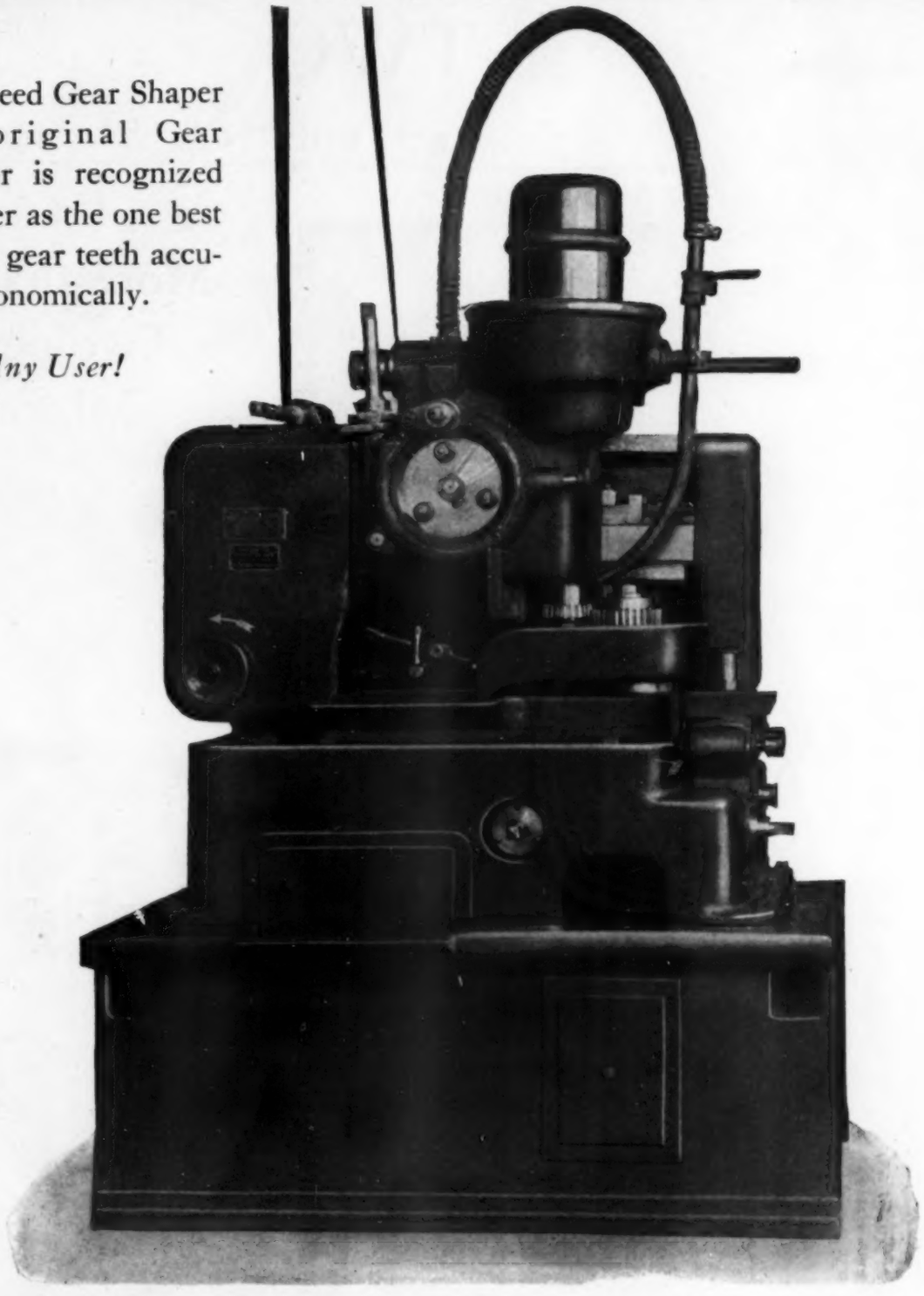
The Gear Shaper cutter, as produced today on fully automatic grinding machines, and inspected by instruments of the utmost precision, is, of course, a superior tool to that first produced—in fact, to that made five years ago.

The Gear Shaper cutter has kept step with the advances made in the art of gear cutting, and has reached its highest state of development as applied on the High-speed Gear Shaper.

The Gear Shaper cutter is a laboratory product made in commercial quantities and sold at such a price that it is generally recognized as the most economical gear cutting tool made.

The High-speed Gear Shaper using the original Gear Shaper cutter is recognized the world over as the one best way to finish gear teeth accurately and economically.

Ask Any User!



THE FELLOWS GEAR SHAPER COMPANY

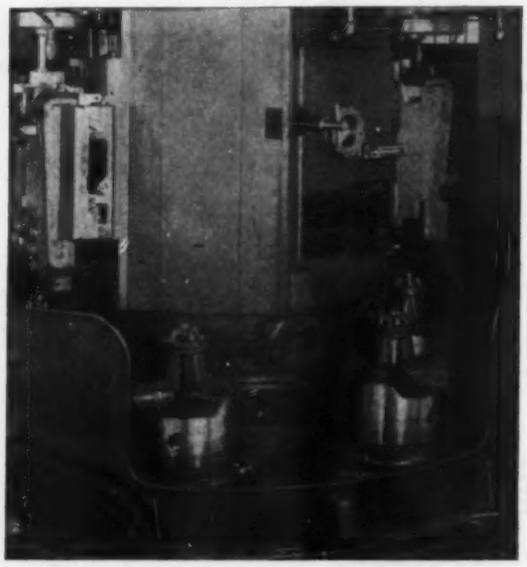
Head Office and Works: 78 River St., Springfield, Vermont, U. S. A.

Branch Office: 651 Book Bldg., Detroit, Mich.

FOREIGN AGENTS: Alfred Herbert, Coventry, England—Great Britain; Alfred Herbert (India), Ltd., Calcutta and Bombay—India; Alfred Herbert, Ltd., Osaka and Tokio—Japan and China; Alfred Herbert (Australasia), Ltd., Sydney—Australia; Societe Anonyme Alfred Herbert, Paris—France and Spain; Societa Anonima Italiana Albert Herbert, Milan—Italy; Societe Anonyme Beige Alfred Herbert, Brussels—Belgium and Holland; Behm and Borman, Berlin—Germany, Czecho-Slovakia and Austria; Aktiebolaget A. Bonthrom, Stockholm—Sweden, Finland and Norway; American Machinery Import Co., Zurich—Switzerland.

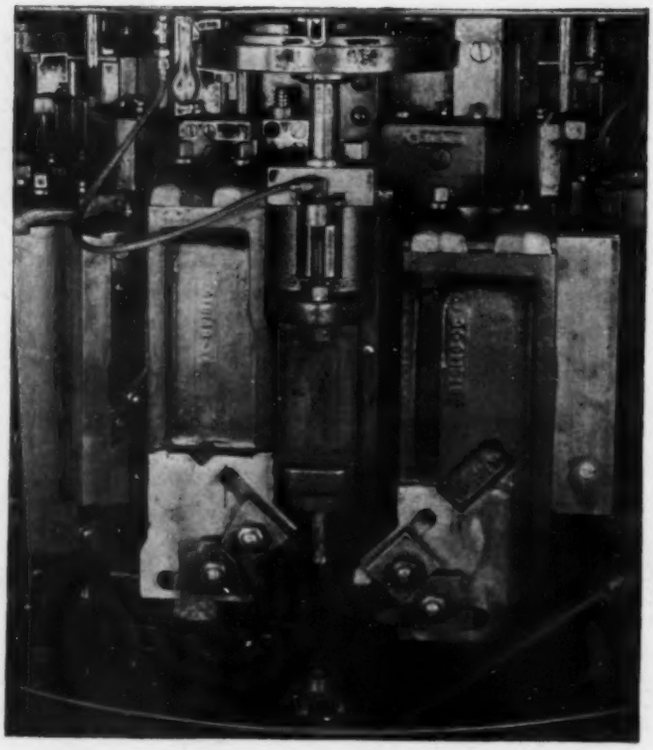
PACIFIC COAST REPRESENTATIVES. Louis G. Henes, 75 Fremont St., San Francisco, 1418 Santa Fe Ave., Los Angeles.

CHUCK TWO ROUGH TWO



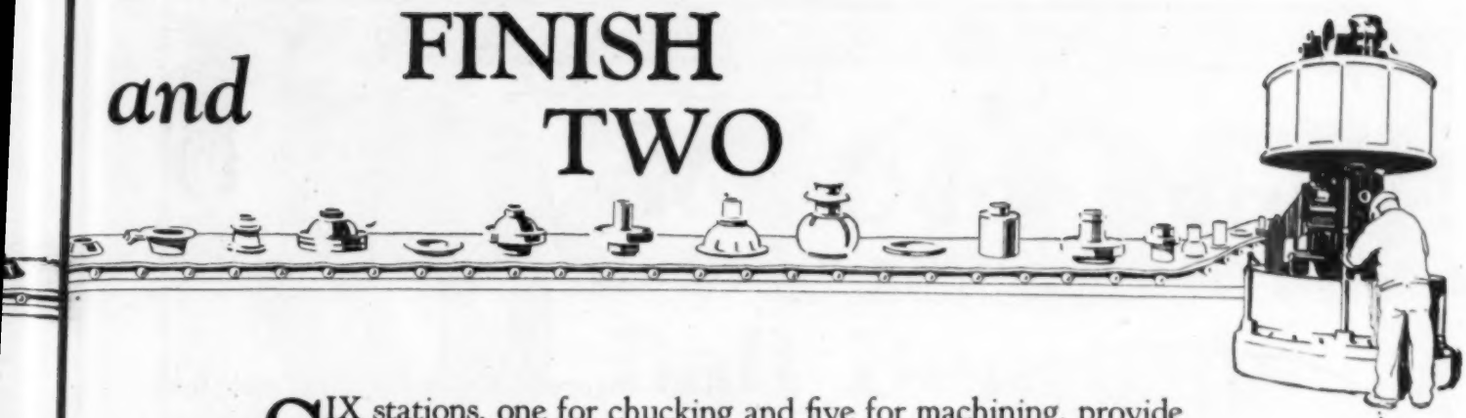
More than Two-per-Minute

A Fan Pulley
On the Mult-Au-Matic
Double-Index Type
50 Seconds per two
Fast Production
Accurate Work
Lower Cost
Extra Economy



BULLARD MACHINE TOOLS

and FINISH TWO



SIX stations, one for chucking and five for machining, provide facilities for several different operations on the same piece with independent speeds and feeds at each station. For simpler combinations of work the Mult-Au-Matic is arranged for double indexing,—two pieces chucked, two roughed and two finished at the same time.

Bullard Engineers can show you how to obtain the greatest service from the Mult-Au-Matic for your particular work. Their estimates of production furnish a basis for comparing other costs with the proposed method and their service is yours for the asking.

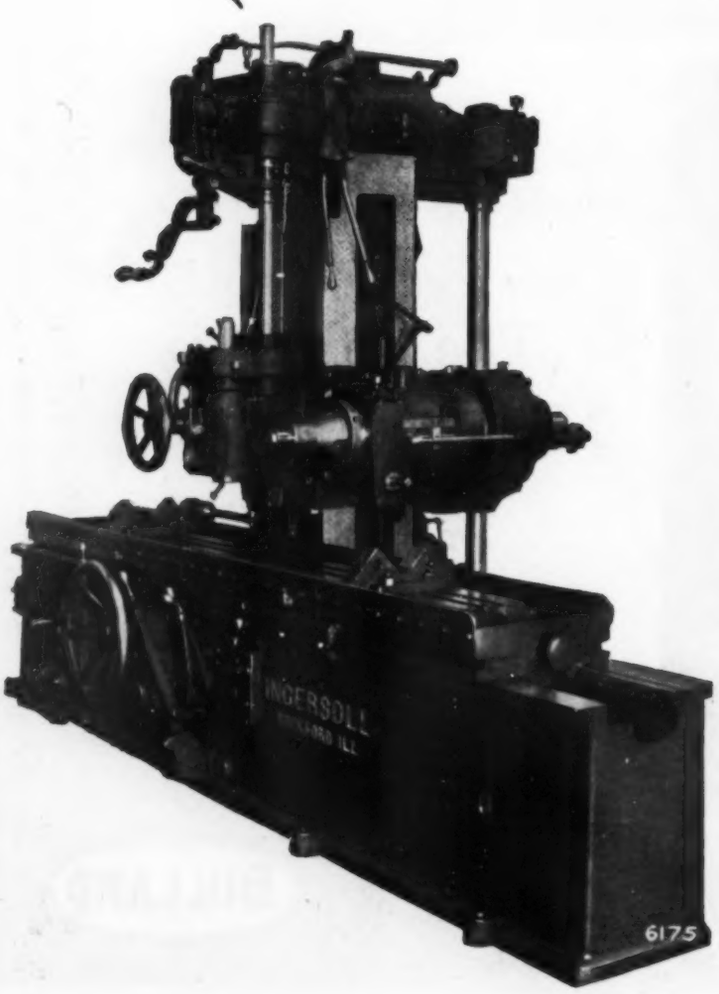
The Bullard Machine Tool Co.

Bridgeport, Connecticut

MULT-AU-MATIC BULLARD

Ingersoll

KEYWAYING MACHINE



This Ingersoll Openside Machine for general keywaying will handle shafting from 1½ to 18 inches diameter and of any length within the capacity of the table.

It has a horizontal head for arbor milling long keyways, and a vertical head for routing out the ends and for end milling small keyways. Both heads are mounted on the same housing, and either may be used at the will of the operator.

We also build an Ingersoll holding fixture, consisting of V-blocks and quick-acting clamps, which lines up any size shafting under the cutters, supports the work, and reduces the set-up time to less than a minute for long, heavy shafts.

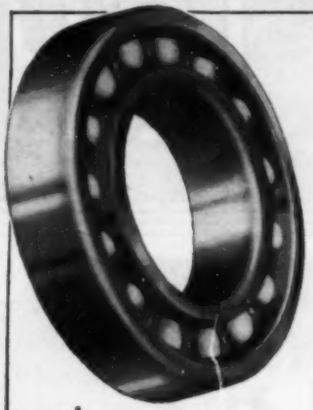
Where either large lots of duplicate shafts or many different sizes of keyways are to be cut, it is possible to save the cost of the equipment in a comparatively short time.

Write for These Bulletins:—

No. 40—"Ingersoll Installations of Milling Equipment."
No. 41—"Ingersoll Drum Type Continuous Milling Machines."
No. 42—"Ingersoll Railroad Rod Milling Machines."
No. 44—"Ingersoll Milling Cutters."
No. 45—"Ingersoll Face Milling Cutter Grinder."

The
INGERSOLL
MILLING MACHINE
COMPANY

Milling Machines and Their Equipment
ROCKFORD, ILLINOIS



New Departure Quality Ball Bearings

Take Friction Out of Operating Costs With Ball Bearings

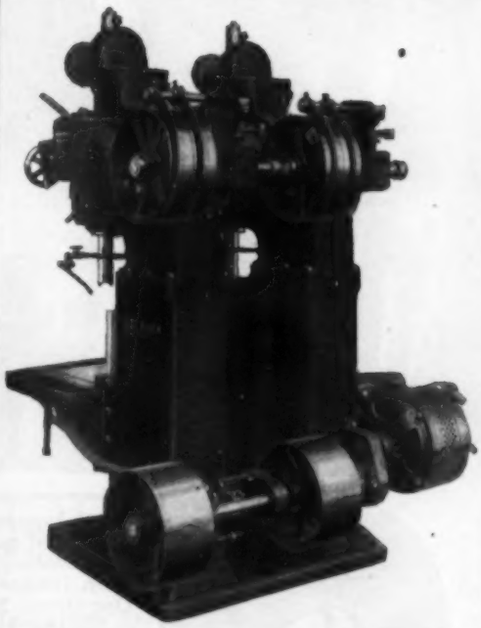
NEW Departure Ball Bearings show no measurable wear and will outlast the mechanisms to which they are applied without readjustment and with only infrequent lubrication.

You can banish friction evils in your machinery more completely with New Departure Ball Bearings than with any other type of bearings. They are practically frictionless and are the ultimate device for maintaining rigid alignment of gears, spindles and shafts in all types of machines where uninterrupted production at low maintenance cost is the objective.

Let our engineers work with your designers regarding your bearing problems. Write for engineering data bulletins on "Ball Bearing Application to Drilling Machines." No obligation.

THE NEW DEPARTURE MFG. CO.
Chicago *Bristol, Connecticut* Detroit

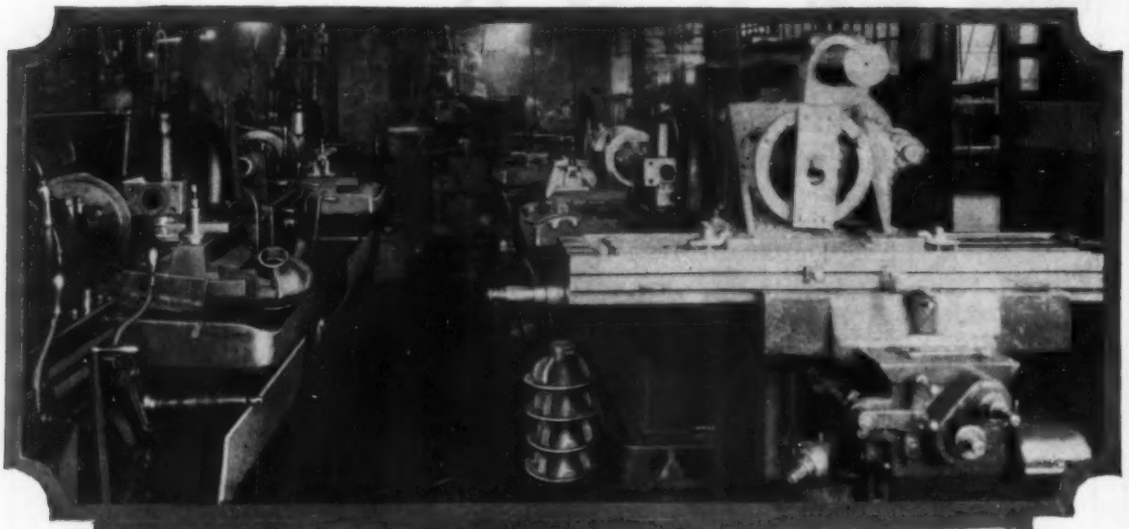
New Departure Economies Are Visible in Profits

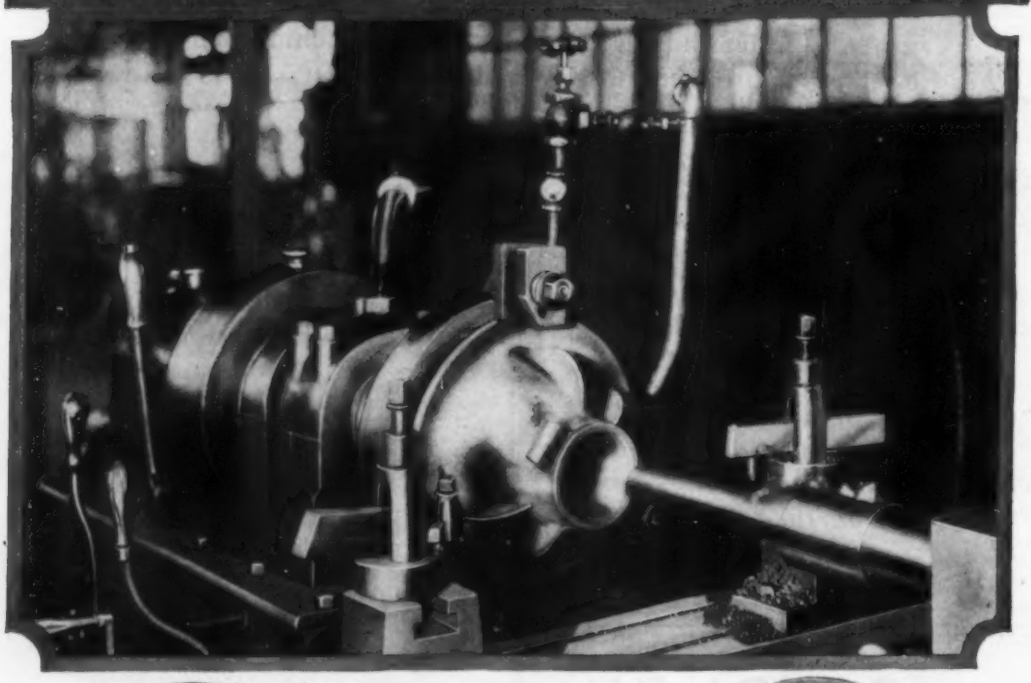


COLBURN

505

POTTER & JOHNST





Machining malleable iron differential gear carriers at the Salisbury Axle Company, Jamestown, N. J.
Operations: Mill lugs (Milling Machine), Rough and finish Bore, Ream and Tap pinion, and bore complete.
Maintaining limits of .0007 in. with one operator attending four P & J and one Miller.

Splitting the labor costs five ways!

Here is an interesting set-up that demonstrates why **Potter & Johnston Automatics** produce parts at such low unit costs.

The Salisbury Axle Company (Automobile) operate a battery of 24 P & J's. These four as shown, plus one Milling Machine constitute a self-contained unit devoted to machining the malleable iron differential gear carrier approximately 11⅛ in. in diameter.

The first operation of milling the lugs is performed on the Milling Machine, the machined surfaces used to locate the castings in the following operations. Placed on the P & J's, the large flange is roughed and finish faced, rough and finish bored, reamed, tapped and bored complete to limits of .0007 in.

One operator attends the five machines in addition to hand Reaming the parts before sending to stock.

That means the operators wages *are split over five machines;* in reality, the direct labor costs are one-fifth as much as when their parts were being machined on Turret lathes.

Steady, sure, high production; the maintenance of close manufacturing limits; the "universal" tooling up capacity whereby five to fifteen surfaces can be machined at one setting; plus the fact that one operator can attend from three to six machines; are the paramount reasons why all the great automobile and accessory firms bank on P & J automatics to keep them abreast of the times.

May we tell you what can be done with P & J Automatics on some of your parts? Merely mail in sample parts or prints with specifications and we will lay them out—*with no obligation on your part.*

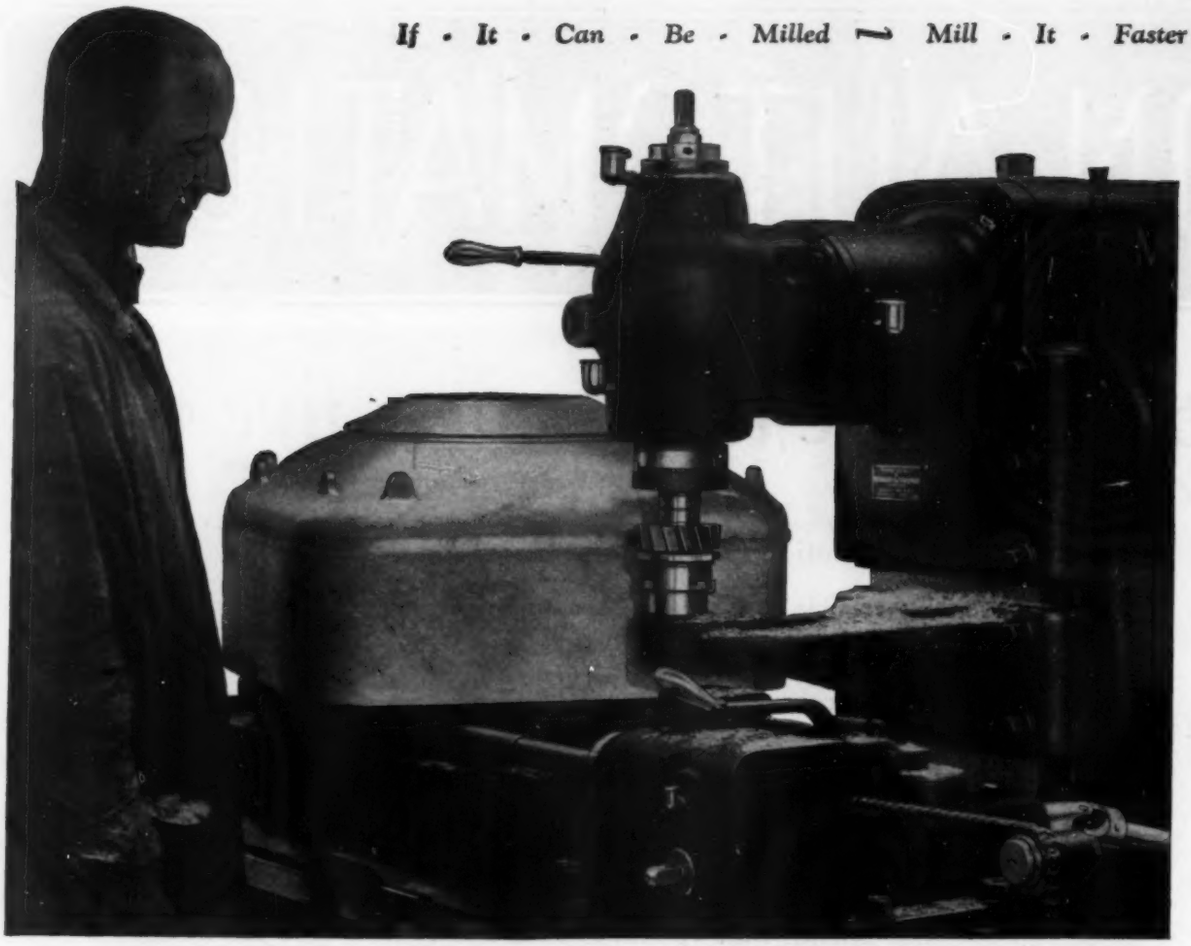
POTTER & JOHNSTON

PAWTUCKET **R. I., U. S. A.**

DOMESTIC OFFICE: New York Office: 270 Madison Ave., Frank H. Robinson, Manager. Detroit Office: Potter & Johnston Machine Co., 3962 Cass Avenue. Chicago Office: 3057 Eastwood Avenue, Leslie J. Orr, Manager. Pacific Coast Offices: Louis G. Henes, 1418 Santa Fe St., Los Angeles, California; Louis G. Henes, 75 Fremont St., San Francisco, California. A. W. Stone, 986 Kenyon Avenue, Plainfield, N. J., Representative for Western New York State and Eastern Pennsylvania. J. P. Cunningham, Headquarters at Factory, Representative for New England. Louis K. Voelk, 910 Helmsdale Road, Cleveland, Ohio, Representative for Ohio and Western Pennsylvania.

CANADIAN REPRESENTATIVE: Arthur Jackson, 32 Glenholme Ave., Toronto, 10, Ontario, and 437 Grosvenor Ave., Westmount, Montreal, Quebec. Automatics and Universal Shapers.
FOREIGN REPRESENTATIVES: L. J. Colomb, 68 Avenue de la Grande Armee, Paris, France, Representative for France, Belgium, Switzerland, Spain and Portugal. Charles Churchill & Co., Ltd., London, Birmingham, Manchester and Newcastle-on-Tyne, England, and Glasgow, Scotland. Ercole Vaghi, Via Parini 10, Milan (12) Italy. Rylander & Asplund, Stockholm, Sweden. Yamatake Company, 7 Nakadori, Marunouchi, Tokyo, Japan. Schuchardt & Schutte, C-2 Spandauer Strasse, 28-29 Berlin, Germany, Representative for Germany, Austria and Czechoslovakia.

If · It · Can · Be · Milled ⟶ Mill · It · Faster!



It Paid for Itself in 3 Months!

AT the Maytag Company's Plant, the flash on the outside of their washing machine tubs was formerly removed by hand with an emery wheel. Seven men were employed for this operation.

K & T Engineers designed equipment that speeded up the job, and at the same time gave the casting a more uniform finish. A labor saving of $40.00 per day resulted. *It paid for itself in 3 months!*

This job is a twin brother to the one exhibited at the Steel Treater's Show in Chicago. Instead of milling a square hole in the cover plate, however, the same principle is applied to the outside edge of the aluminum tub.

A rotary table and reciprocating slide are again employed, but this time a heavy counter-weight holds the work piece into the cut. The casting itself is the cam, and the travel is governed by the tub bearing against a roller which has the same diameter as the cutter, and is located directly below it. Thus the flash is evenly removed from all sides. Of course, the clamping is by air — to save time.

Specifications:

Machine: No. 2B Plain
Feed: 45" per min.
Speed: 700 rpm
Cutters: 3½"x1x1¼" Plain mill
Cut: ⅛ to ½" deep, 3-16" wide
Material: Aluminum
Finish: Smooth
Production: 44 tubs per hour

Our slogan, "If It Can Be Milled — Mill It Faster" is still working, and we'd like to apply it to one of YOUR jobs.

KEARNEY & TRECKER CORPORATION
Milwaukee, Wisconsin

MILWAUKEE MILLING MACHINES

KEARNEY & TRECKER

COLBURN

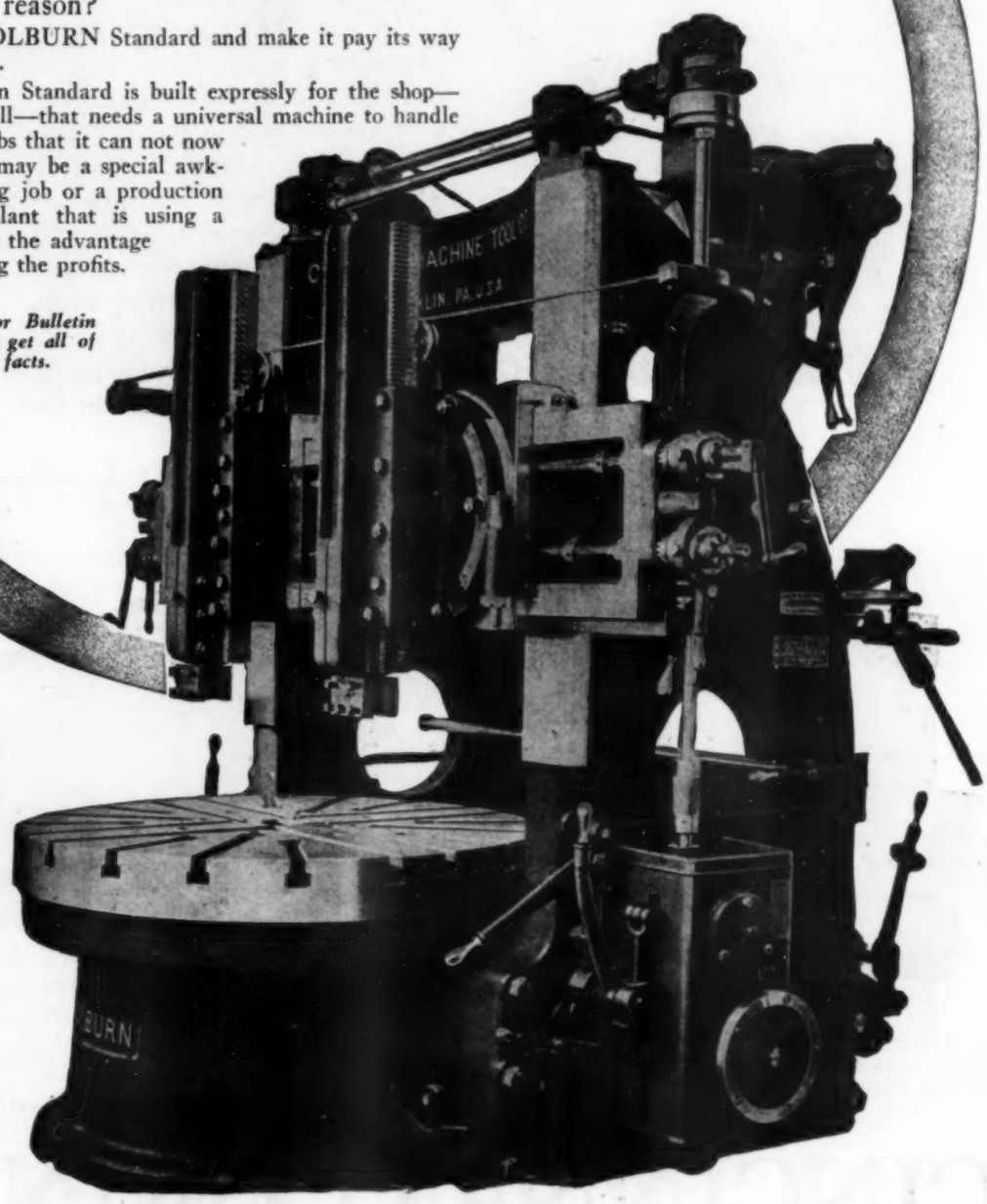
Standard Boring and Turning Mill

How many jobs do you have to turn away each year because your equipment isn't adequate to handle them? How many jobs do you try to handle on your present equipment—and perhaps lose money on, for the same reason?

Install a COLBURN Standard and make it pay its way in your shop.

The Colburn Standard is built expressly for the shop—large or small—that needs a universal machine to handle the many jobs that it can not now handle. It may be a special awkward turning job or a production job—the plant that is using a Colburn has the advantage and is getting the profits.

Write for Bulletin 401 and get all of the facts.



CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL
CORPORATION
of America
ROCHESTER, N. Y.

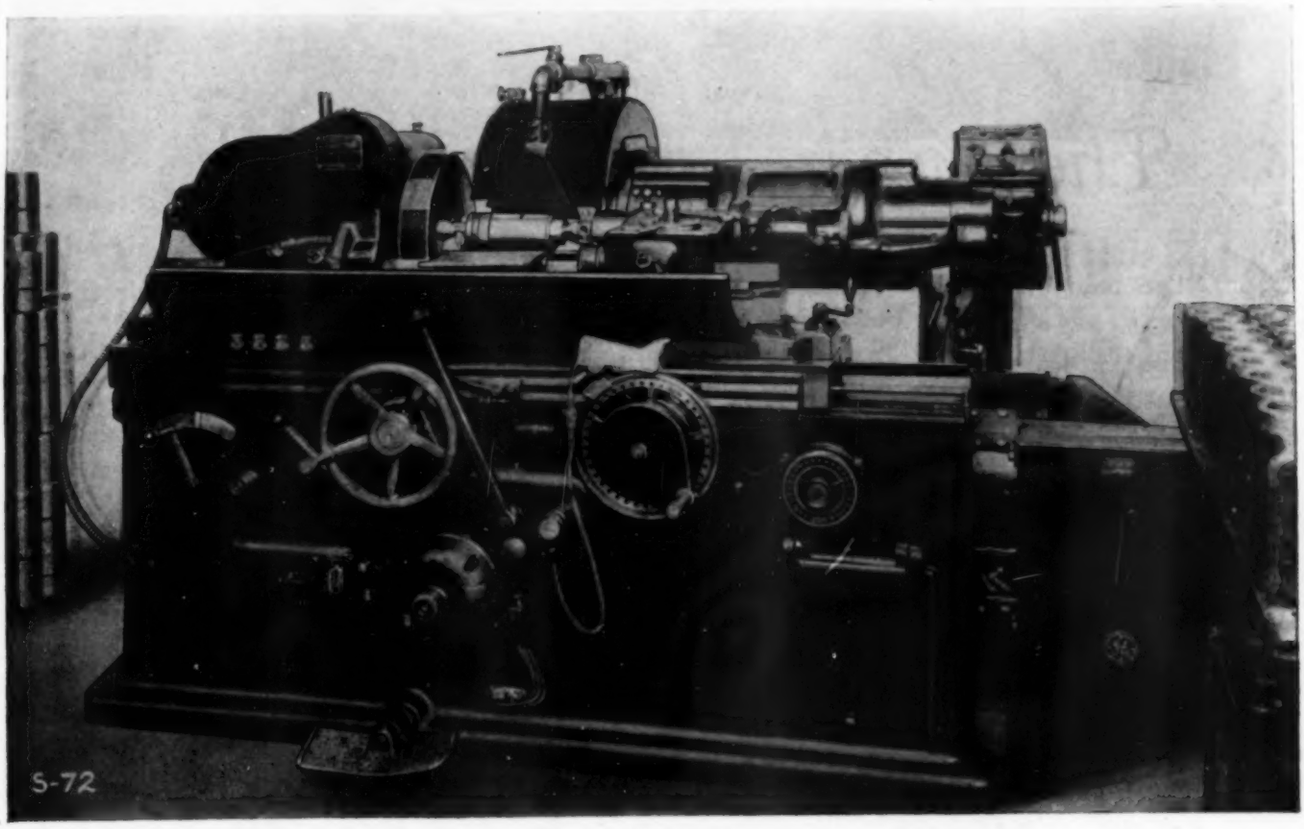
HOW TO USE OUR SERVICE

No matter what your Cylindrical Grinding problem may be we are ready to help you. Thru our many contacts with industry, we have a large store of information upon which to draw to assist **you** in increasing **your** production and lowering your costs. All that is necessary is to send us blue prints of your work for a preliminary survey. Send also the facts regarding production, finish, limits and other requirements. We will promptly make you a layout and tell you what we can do. If we have been able to produce interesting facts, we can then make a detailed survey and layout either at our factory at Cincinnati or personally at your plant. It will *pay you* to let us show you what we can do for you on your grinding problems.

Our New Cincinnati Plant devoted exclusively to the manufacture of Grinding Machines.

CINCINNATI
MAKES MORE MACHINE TOOLS IN GREATER VARIETY THAN ANY OTHER CITY IN THE WORLD
TO SEE AN UP-TO-DATE MACHINE TOOL COME TO
CINCINNATI

CINCINNATI GRINDERS



(Patented)

Plunge Cutting Did the Trick!

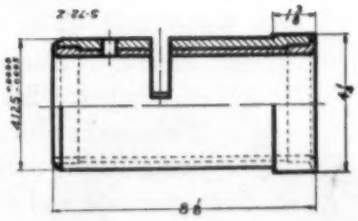
A motor liner is ground on an arbor by infeeding the wheel to an electric stop. A special driver saves digging. One arbor is loaded while another is being ground.

The machine is equipped with an oscillating attachment thus keeping the wheel face from wearing unevenly, and decreasing the number of wheel dressings while greatly improving the finish.

An electric infeed gives a smooth, uniform motion eliminating the periodic strain formerly placed on wheels by intermittent types of cross feeding mechanisms. It increases production by using wheels to the fullest capacity under all cuts.

Work speeds and wheel infeed speeds are changed electrically. A foot treadle operates a dynamic brake, instantly stopping the work, leaving the operator's hands free for loading and unloading. This eliminates the extra motion incident to starting and stopping work revolutions by hand. This machine has been so productive that it paid for itself within a period of twelve months.

"A New Service with New Methods on Grinding"



Name of Part—Motor Bearing Liner.

Operation—Finish Grind 4.125 in. diameter x 5.75 in. length surface.

Stock Removed—.012 in.

Limits—+.0000 Maximum. —.0005 Minimum.

Production—35 Bearings per Hour.

Finish—A No. 1.

Machine—12 x 18-in. Cincinnati Plunge Cut Grinder.

INCORPORATED

DANBURY, CONN.
CINCINNATI, OHIO

The Super Looks Forward

"I've been interested a whole lot in this series of ads on the possibilities of welded steel construction," remarked the Super, as he turned the pages of this week's issue. "There seems to me to be a world of opportunity here for saving construction costs and for increase of strength per unit of weight."

"This company has a regular text-book on welding, I see," said Mac, the Assistant.

"Charging a price for it, too," observed the boss. "That makes me think there must be something unusually good in it. Let's get it on this 5-day approval offer."

"Right! I send today."

"If we had quantity threading to do," the Super said, as he examined another advertisement, "I'd certainly get prices on this thread miller. See? Instead of starting in at the end as usual and rotating the work, this machine uses a hob that comes in from the side and does the whole job while the work is turning just once."

"Guarantees accuracy to one-thousandth of an inch, too."

"Good work, good work, Mac! There's real brains gone into that machine."

The two men leafed onward.

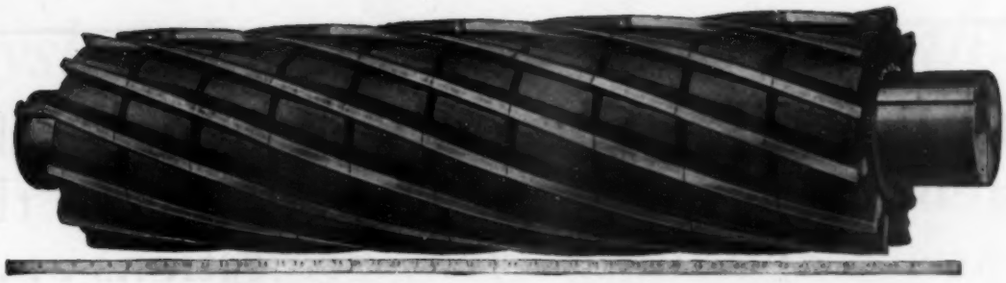
"This ad called '1927 Plans' opens up a train of thought in my mind. I can remember not so many years ago when a fellow bought a machine and it was just a machine. Then he had to figure out how to apply power to it and how to get it to do the work—dope out chucks and jigs and whatnot and go to a lot of expense before the machine would produce. Now the wide-awake machine builders are not selling us machines but finished pieces. This company here, for example," he put his thumb down on the double-page, "say they've taken steps to give even more prompt and more extensive service on milling methods in 1927. And here's a sample job—complete production data so you can size up the machine for your work. That's all to the good, Mac."

"The ball and roller bearing people and the grinder builders are doing the same sort of thing," suggested the Assistant.

"Of course they are! It's the real logical step in selling, it strikes me."

"Here's an ad that's worth some study, Mr. Hawkins," said Mac, "this one on hydraulic equipment. It's for builders of machine tools and for us, too—offers a way to add up-to-date control to older machines."

"And a way to apply power to a lot of hand operations, too," added the Super. "Let's send for their catalog and find out just what their line covers."



As accurate as a solid milled or ground cutter

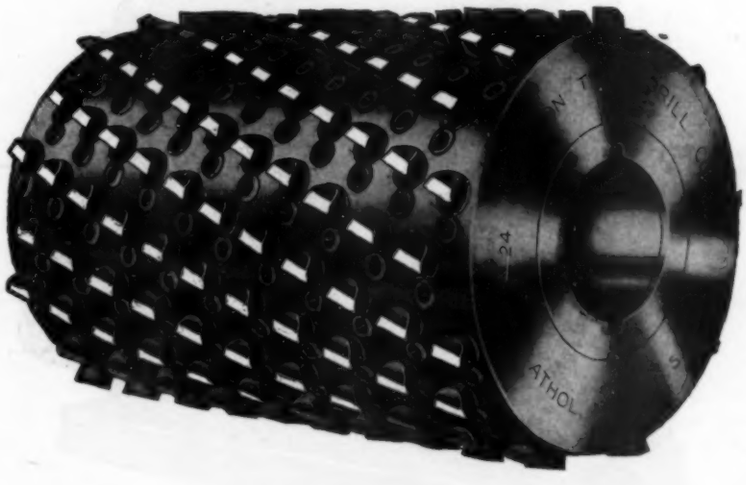
It is impossible for the teeth of the Union Inserted Tooth Milling Cutter to "slip" when once set up for service.

The method for holding the teeth in position on the Slabbing Cutter is a "Union" development. Teeth cannot loosen or fall out, yet they can be readily removed or replaced when worn. Teeth for all our standard types are carried in stock.

We make Inserted Tooth Cutters to your own design and guarantee them to stand up to the work for which they are made.

Catalog showing complete line can be obtained from the nearest Union Agent.

UNION
Inserted Tooth
Milling Cutters



Union Twist Drill Co., Athol, Mass.

Chicago Store—11 So. Clinton St. New York Store—62 Reade St.

Makers of All Kinds of Cutters, Twist Drills, Reamers, Taps, Dies, etc.

AGENTS THROUGHOUT THE WORLD

Tools you buy again

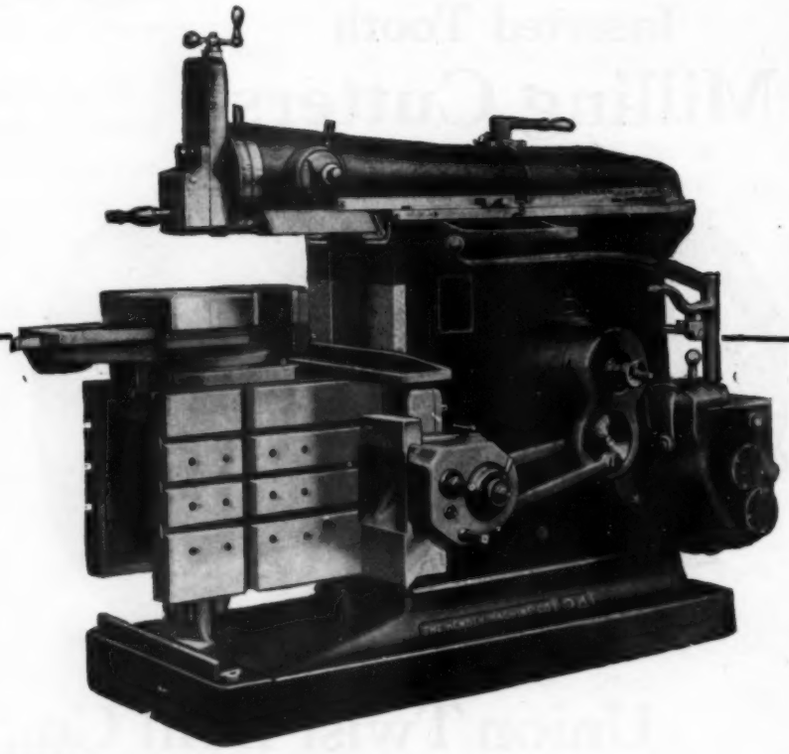
Look at the simple clean-cut design of the Hendey Shaper . . . no overhang to the parts . . . no unnecessary projections . . . a production shaper, quality built for long years of profitable service

A flick of the tumbling lever and the Hendey patented cross-feed of 25 notches in steps of .008 in. to .180 in. per stroke swings into play; can be varied while machine is in motion, feed taking place on the reverse stroke only. The feeds are plainly marked in thousandths; no computing necessary; no chances for errors.

Note that the speed box is very compact, encroaching on no extra floor space, and operates smoothly and noiselessly with gears running in oil.

Power down feed—the simplest ever devised. Can be adjusted while ram is in motion. Operates at all speeds without throwing by. Any feed from .005-in. to .060-in. in steps of .005 in.

These are just two of the impressive features of Hendey design—send for literature describing the others.



Hendey Shapers

LATHES
SHAPERS

HENDEY
MACHINE CO., TORRINGTON, CONN.

MILLING
MACHINES

Chrysler Jumps Production on this Gear with Heald SIZE-MATIC

No Plugs
No Gages

Grinding sliding gear for transmission on Chrysler 70 car
Hardened steel 1½-in. long by 1.250-in. dia.
Stock removed, .015 to .020.
Limits .001
Hole must be absolutely true with pitch line of gear
Day in and day out, production 85 to 89 pieces per hour

Former production on this gear with the Heald No. 70 was from 50 to 55 per hour while the SIZE-MATIC is turning them off at a rate of 85 to 89 per hour day in and day out.

Notice the short, stubby spindle with the diamond ready to instantly drop into position dressing wheel just before the finish cut is taken. The gear is centered by a key and spline so that the hole runs absolutely true with the pitch line.

It is by such jumps in production and closeness of accuracy that Chrysler is able to put out such a high grade product at a price that continues to hold the popular demand.

Mr. E. R. Burns, Efficiency Engineer of the Chrysler Corporation, Newcastle Plant, says of the Heald SIZE-MATIC, "This machine being automatic not only increases production but reduces scrap, at the same time maintaining a close degree of accuracy."

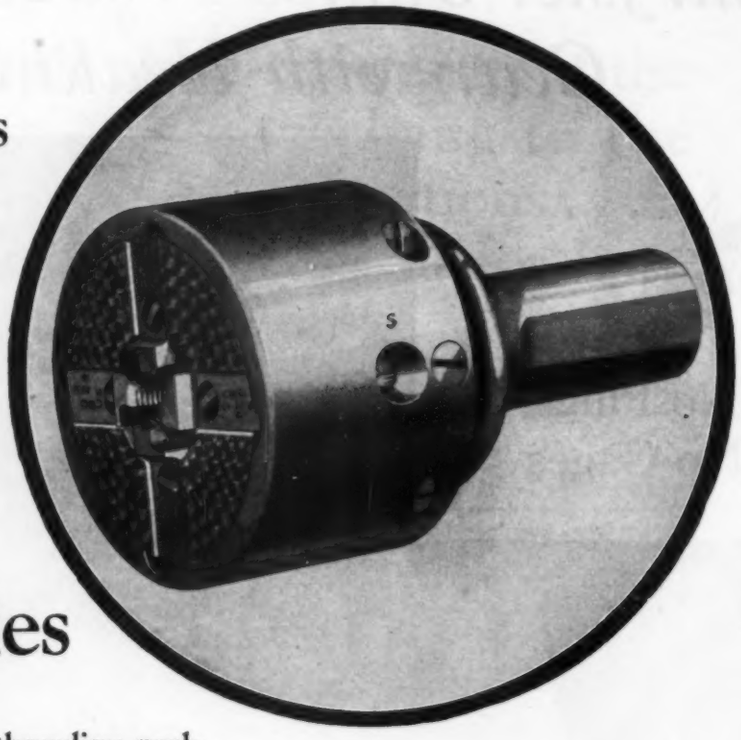
We can do the same for you if you will give us the chance.

The Heald Machine Company

35 New Bond St., Worcester, Mass.

Has held the trade's confidence for over 100 years

Accurate Chasers in a Dependable Head—



Namco Opening Dies

When you put your threading problems up to Namco, you will discover that they can be solved by just two types of tools, as far as work between $\frac{1}{8}$ in. and $2\frac{1}{2}$ in. in diameter is concerned.

These two types of tools are the Style S Namco Dies for stationary die spindles and the Namco Style R Dies for revolving die spindles. The one illustrated is Style R.

These dependable Namco Die Heads are heat treated and all vital surfaces are accurately ground. They are "chip insulated" and will never need to go to the tool room for adjustment.

Namco Chasers are made to suit *your* particular requirements. They are checked to close physical and manufacturing specifications. Every set brings high mileage of clean, accurate threads to your plant.

Write for our Die Folder—
Tell us of your threading problems.

The National Acme Company

Cleveland, Ohio — Windsor, Vt.

New York Detroit Chicago

Makers of Acme and Gridley Multiple Spindle Automatics, Gridley Single Spindle Automatics, and Gridley Multiple Spindle Chucking Machines at Windsor, Vermont and NAMCO Self Opening Dies, Collapsing Taps and Screw Machine Products at Cleveland, Ohio

Waste—

Successful business is a constant fight against the insidious inroads of waste

Wasteful Buying

Often we think of waste in terms of material spoiled or merchandise become obsolete. Yet waste may creep in anywhere—into buying methods for example. It *is* wasteful to spend time interviewing ten salesmen if you can buy the merchandise and get the information you need from *one well informed man*. It is wasteful to write *ten* orders, mail *ten* letters, check *ten* invoices and remit by *ten* checks when *one* will answer.

Time is Money

Apart from all the extra costs in postage, clerical work and freight or cartage, consider alone the element of time. Your time is your capital as truly as your real estate, equipment, or your inventory.

To find one good source of supply and concentrate buying there saves precious time for you and leaves you free to turn that saved time into extra profit or to enjoy it in needed recreation.

You Can Begin with Small Tools

We suggest that you try the experiment of concentrating small tool purchases. If it proves satisfactory, as we are sure it will, you will find it easy to extend the principle to other departments of your business.

In the small tool field you will find in the current GTD catalog complete data on screw plates, taps, dies, drills, reamers, die stocks, tap wrenches, gages, pipe wrenches, cutters, and pipe threading tools.

A Known Line is Safe

You can safely concentrate on GTD. Men who use small tools know the line. They know something of the reputation and years of experience that lie back of GTD threading tools. They know the GTD mark and will accept it as a guarantee of workmanship, quality and fair value. Hence, these tools are acceptable to the most particular. You will not have to argue GTD merit.

Send for Catalog

Every small tool buyer can use GTD Catalog No. 49. Beside much valuable information on small tools it describes dealer helps for merchants and contains useful data for tool users. It is a book that will help you *buy* small tools to advantage. Mail the coupon for your copy.

Come to Headquarters!

MACHINE TOOL DIVISION

GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS

New York—15 Warren St. Chicago—13 So. Clinton St.
Detroit—224-226 W. Congress St.

Greenfield Tap & Die Corp.,
Greenfield, Mass.

Please send me a copy of your catalog No. 49.

Signed .....

Street .....

City ..... State .....

Am. Mach., Dec. 30

Gray Planers

Plane Better; Scrape Less

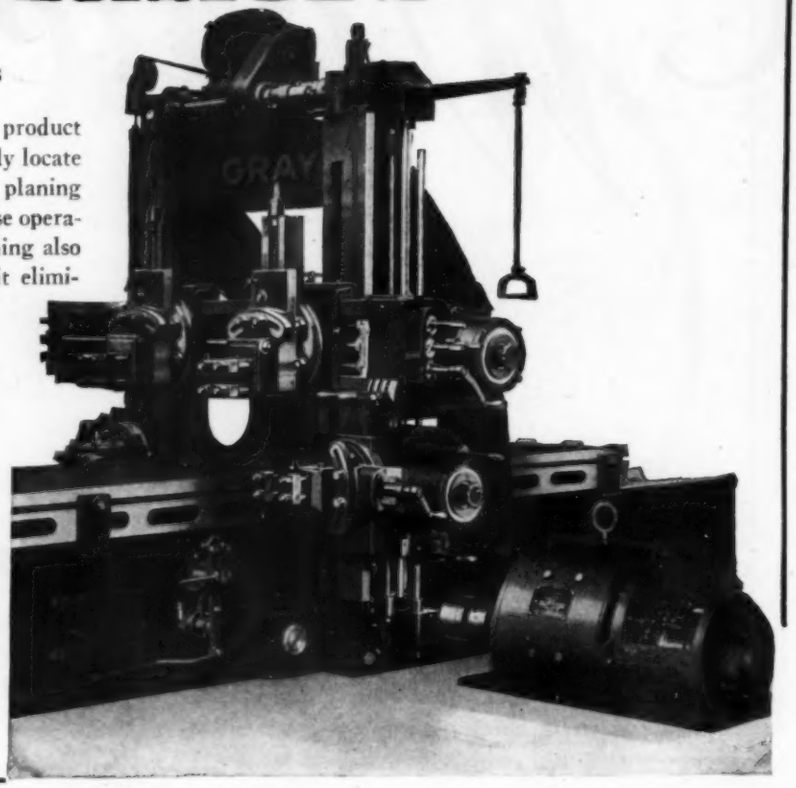
The first step in the manufacture of your product is planer work. Planed surfaces frequently locate the jigs for subsequent operations. Better planing means that it will be easier to perform these operations accurately and quickly. Better planing also makes your product easier to assemble—it eliminates a great deal of filing and scraping.

This is the time to get ready for competition. Bring your equipment up to date. Begin at the beginning—make it possible for your operators to give you the best of planer work.

Install Gray Planers—Openside and Double-Housing.

Send for our new catalog.

THE G. A. GRAY CO.
Cincinnati, Ohio



When we make your special tools

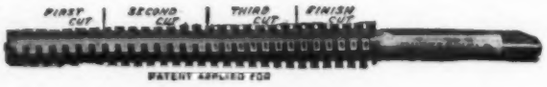
Your REAMERS—TAPS—DIES—receive the same careful attention as our standard line.

The only difference, you get the price benefit of massed production without the everlasting overhead tax of your own toolroom.

Let us show you the positive economy of Butterfield Special Tool Service.

Prices and designs cheerfully submitted upon receipt of specifications.

And when you consider the "business end" of your high-priced production equipment is absolutely dependent upon Small Tools, it's folly to buy anything but the best.



BUTTERFIELD
THE BETTER TOOLS

BUTTERFIELD & CO. DIVISION

Union Twist Drill Co.

Derby Line, Vt., U. S. A. Rock Island, Quebec Canada
Stores: New York, 62 Reade St. Chicago, 11 So. Clinton St. East Toronto, 67 Adelaide St., West. Montreal, 131 St. Paul St., West

BARNES

UPRIGHT DRILLS

Stationary Heads 8 inch to 25 inch swing.
Sliding Heads 22 inch to 50 inch swing.
Gangs in any combination.

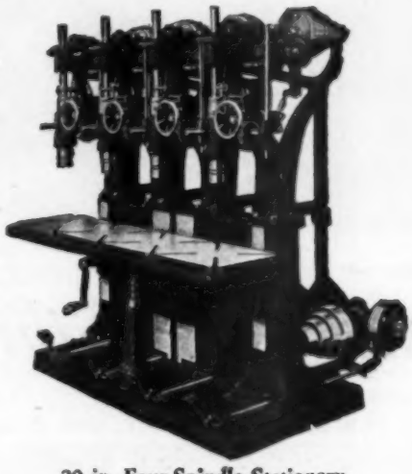
HORIZONTAL RADIAL DRILLS

In three sizes

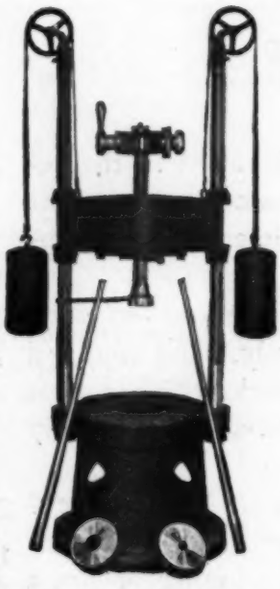
ADJUSTABLE SCREW PRESSES

In three sizes

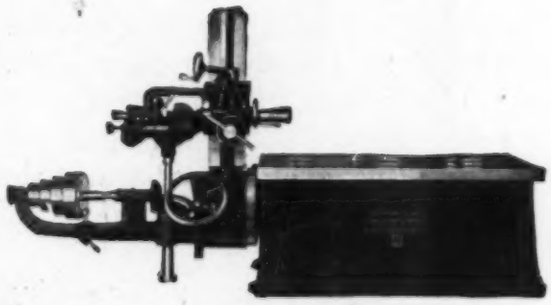
22½ in. Stationary Head Drill



20 in. Four-Spindle Stationary Head Gang Drill



Adjustable Screw Press

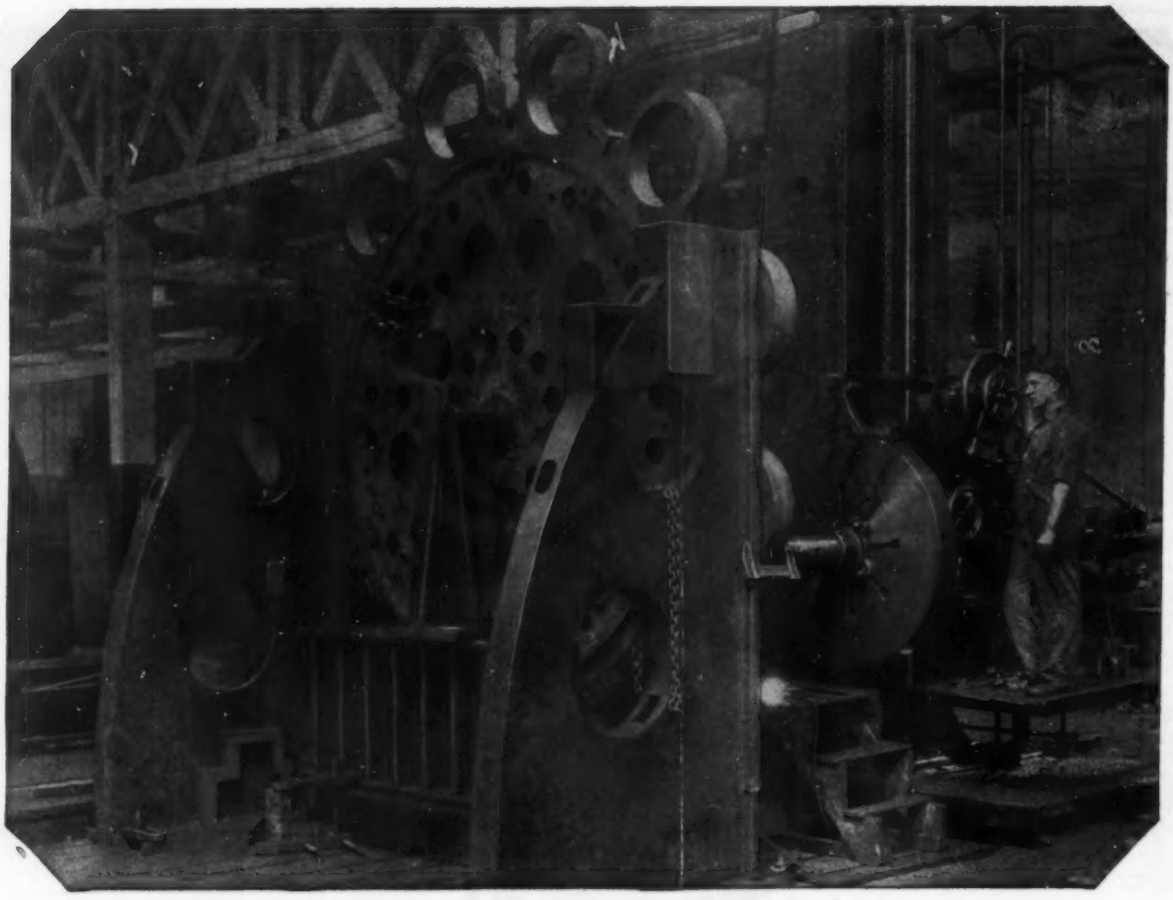


No. 3 Horizontal Radial Drill

Established in 1872

W. F. and John Barnes Co.

ROCKFORD, ILLINOIS



Can you do *this?*

Can you bore the holes in this casting without a floor borer? Perhaps you have equipment that can be rigged up to do it. Even if you have, could you compete with the floor borer in cost? That is very doubtful if not impossible.

The floor borer finishes all these holes located at different heights and different horizontal positions without moving the heavy, awkward-to-handle piece of work.

Moving and lining up this casting for each hole would take a lot of time and cost a lot of money. With a floor borer, the spindle is raised to the desired height and the column traverses along its base to the correct horizontal location.

No other machine can do such work so economically. And there is a variety of heavy work which a floor borer does well and at an extremely low cost.

Ask us for details. A Niles sales engineer will be glad to go over your work and tell you whether or not a Niles Floor Borer would save you enough to justify installing it.

The Niles Tool Works Company

DIVISION NILES-BEMENT-POND COMPANY

Hamilton, Ohio

A CHALLENGE!

Try to buy a *second hand* P&W Jig Borer

You'll find it cannot be done. There is not a single one on the second hand market.

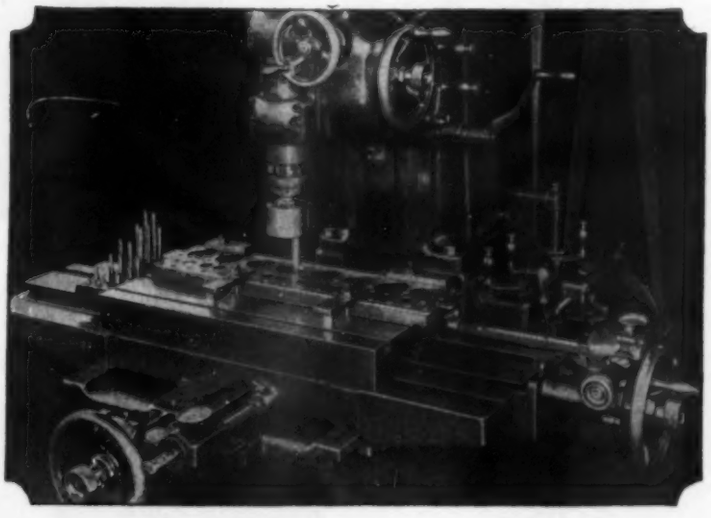
We started building Jig Borers twelve years ago. Many have been sold since to a variety of industries. All but three are still in the shops of the original purchasers. The three were in plants which were closed down or where changes in the nature of the business occurred. And how quickly the Jig Borers were snapped up at the sales.

It is a hopeless handicap to do much jig and fixture work without a P & W Jig Borer. Whether you have competitors you are fighting or your only fight is with your own costs, the handicap is there.

Investigate the remarkable performance of the Jig Borer. Find out how it practically eliminates layout work and secures accuracy to ten-thousandths by direct reading of two dials. Get the whole story of this machine now. *Write for a copy of Circular* No. 150-1.

One manufacturer recently said he could not afford to give jig and fixture work to companies who did not use a Jig Borer. Cost was too high.

PRATT & WHITNEY CO., *Hartford, Connecticut*
Division NILES-BEMENT-POND COMPANY

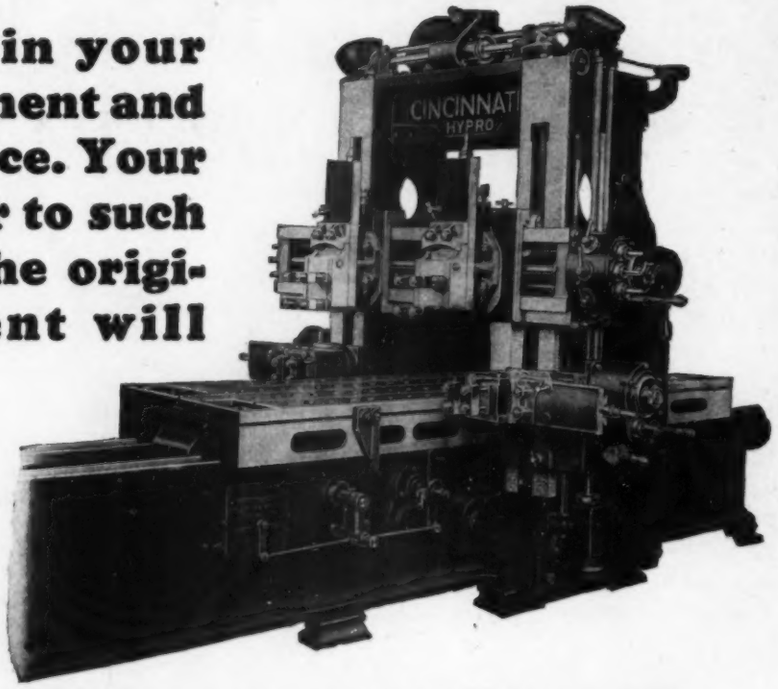


An 8-cylinder Automobile Template being bored on a P & W Jig Borer in the shops of Frederick Coleman & Sons, Detroit, Mich.

PRATT & WHITNEY

START 1927 RIGHT

Put a HYPRO in your Planer Department and see the difference. Your saving will soar to such a height that the original investment will look insignificant. Ask our engineer to prove this statement.



THE CINCINNATI PLANER CO., CINCINNATI, OHIO

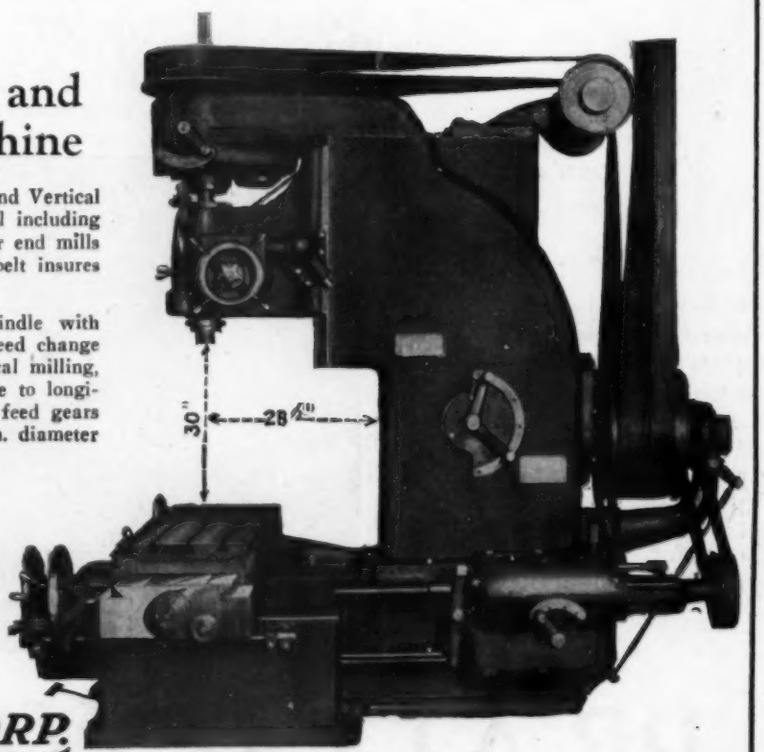
The New Model No. 6 BECKER Die Sinker and Vertical Milling Machine

Features of the previous BECKER Die Sinkers and Vertical Millers have been maintained in this new model including belt drive to spindle permitting proper speeds for end mills and die sinker's cutter. A 5-in. spindle drive belt insures sufficient power to the cutter.

New features include triple gearing head, spindle with either clutch type or threaded nose, speed and feed change mechanism, power down feed to head for vertical milling, adjustable head and spindle quill, rapid traverse to longitudinal and cross feeds in either direction. All feed gears of alloy steel, running in oil. Rotary table 26-in. diameter can be supplied if desired.

SPECIFICATIONS:

Table travel—longitudinal	62 or 72 in.
Table travel—cross	24 in.
Adjustment of head on column	18½ in.
Adjustment of spindle	11½ in.
Working surface of table	72x20 in.
Distance spindle to table, maximum	30 in.
Distance spindle to column	28½ in.



REED-PRENTICE CORP.
MACHINE TOOLS
WORCESTER MASS. U.S.A.
667-677 Cambridge Street

Branch Offices:
New York, N. Y. 140 Broadway—1810 Singer Bldg.
Detroit, Mich. 3-245 General Motors Bldg.
Representatives throughout the World

The *low labor cost* of automatic operation, the *precision* of the toolroom, the *speed* of a high-geared single-purpose machine

The manifold advantages of the Hanson-Whitney Thread Miller are readily grasped at once. Consider the ordinary method of threading a part, say of 20 threads per inch. Using a single point tool, the work must make 20 revolutions before it is finished. On this speedy Hanson-Whitney Thread Miller, a perfect thread, superior in both finish and precision, is turned out in *one revolution of the part. Practically from ten to twenty times as much work is produced.*

Because the approach, setting to depth, the cutting and return, are accomplished *automatically,* 95% of the time is *actual cutting time.*

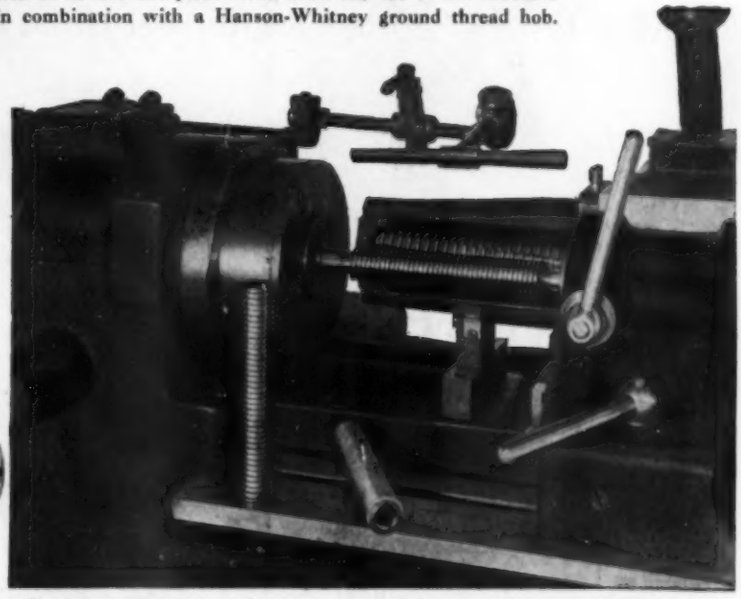
Absence of spoiled work is another guarantee of semi-automatic operation; once the job is set *an unskilled* operator can insert and remove the parts.

Easily changed from one job to another; internal as easily handled as external threads, with special attachments for eccentric relieving Taps, Chasers, etc.

This sturdy adaptable machine will effect big economies in your production scheme, just as it is doing in many of the leading shops.

Full information with production estimates gladly furnished upon receipt of samples or specifications. *Write for illustrated bulletin!*

This illustration shows a set-up for milling the screws used in lathe chucks. Smooth finish and a guaranteed accuracy of .001 in. in lead and pitch result from the use of this machine in combination with a Hanson-Whitney ground thread hob.

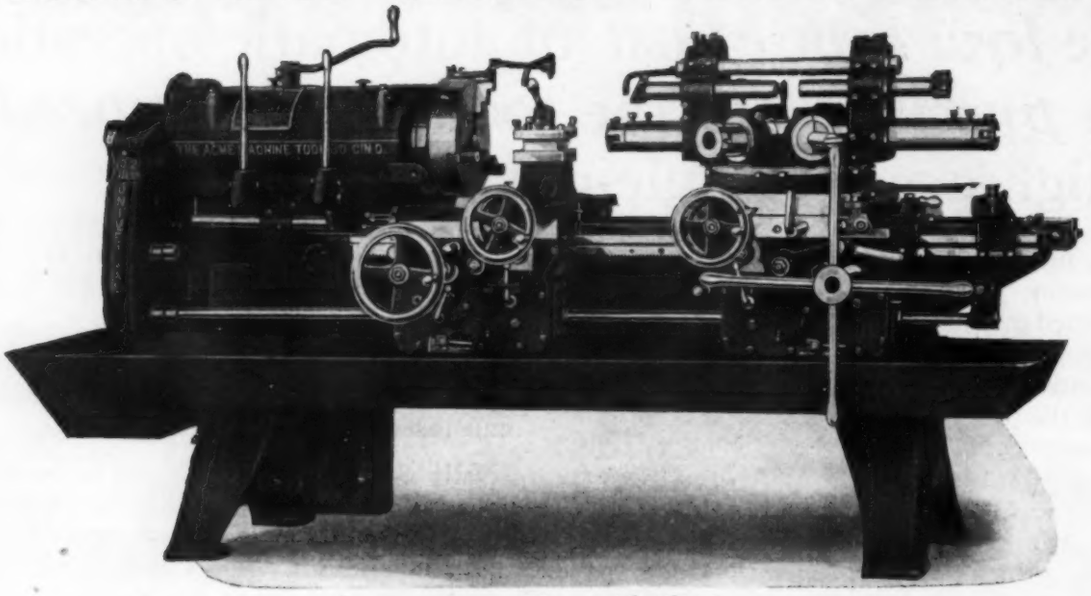


Domestic Representatives: New York, N. Y., L. C. Biglow & Co., Inc.; Syracuse, N. Y., George McPherson; Boston, Mass., George C. Steil; Philadelphia, Pa., D. J. Normoyle; Pittsburgh, Pa., William K. Stamets; Cleveland, Ohio, William K. Stamets; Cincinnati, Ohio, Seifreat-Elstad Mchy. Co.; Dayton, Ohio, Seifreat-Elstad Mchy. Co.; Detroit, Mich., A. G. Brice; San Francisco, Calif., A. H. Coates Co.; Chicago, Ill., E. H. Huntington; Toronto, Ont., Canada, Arthur Jackson.

The Hanson-Whitney Machine Company

Hartford, Conn., U.S.A.

Acme Duo Control Turret Lathes



Amazing Possibilities

Your estimates on lathe work are likely to be completely upset when you put the new Acme No. 2 Duo Control in operation.

Astounding figures, showing up to 400% increase in production are checking the claims made for this lathe. Note these points:

Full universal cross-sliding turret—a bearcat for easy tooling and versatile set-up. All feeds in aprons. Individual speeds to each carriage.

Patented all-geared head, with single lever control, automatic multiple disc friction, clutch and *oil hardened alloy gears.* 12 speeds, instantly changed.

Automatic cutoff of power during rapid traverse—a new safety feature.

Let us estimate on your work. Get the Acme bulletins.

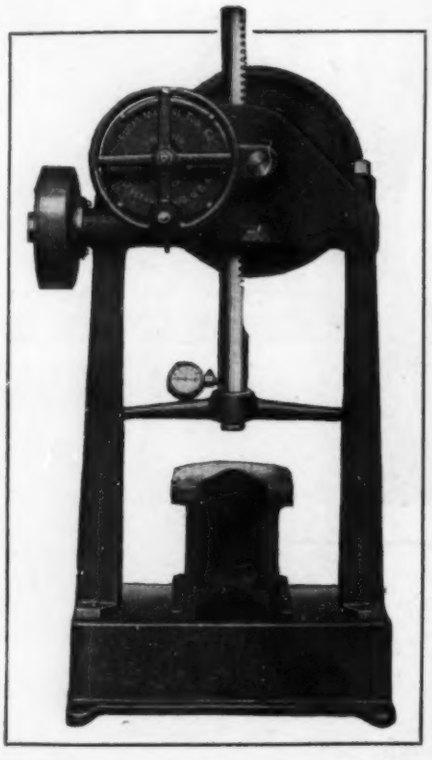
ACME MACHINE TOOL COMPANY, Cincinnati, Ohio

Mechanical power is cheaper than human muscular energy

In the fast and easy operating

LUCAS
Power Forcing Press

the belt does the work and saves the workman's time and energy for other use.



THE LUCAS MACHINE TOOL CO.

NOW AND ALWAYS OF

CLEVELAND, OHIO, U. S. A.

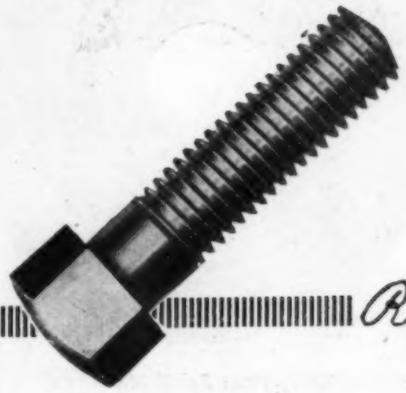
Judge by Performance

If you are getting short chaser life—few threads per grind; imperfect lead; inaccurate pitch diameters; then's the time to check performance.

Ask Geometric users what they think of Geometrics. Buy a Geometric Die Head. Try it out alongside your present tools. If it doesn't produce better threads and more of them per grind, return the die and it won't cost you a cent.

Take the Style KD Geometric pictured below. That's the head that the big users are demanding for live spindles. It's compact, it's positive, it's built with precision, it will produce accurate threads for you. Try it out—5 sizes:- 5/16-in., 9/16-in., 1-in., 1¼-in. and 1½-in. in stock. Other sizes to order.

Also manufacturers for more than 30 years of the well known Geometric line of Collapsing Taps and Threading Machines.



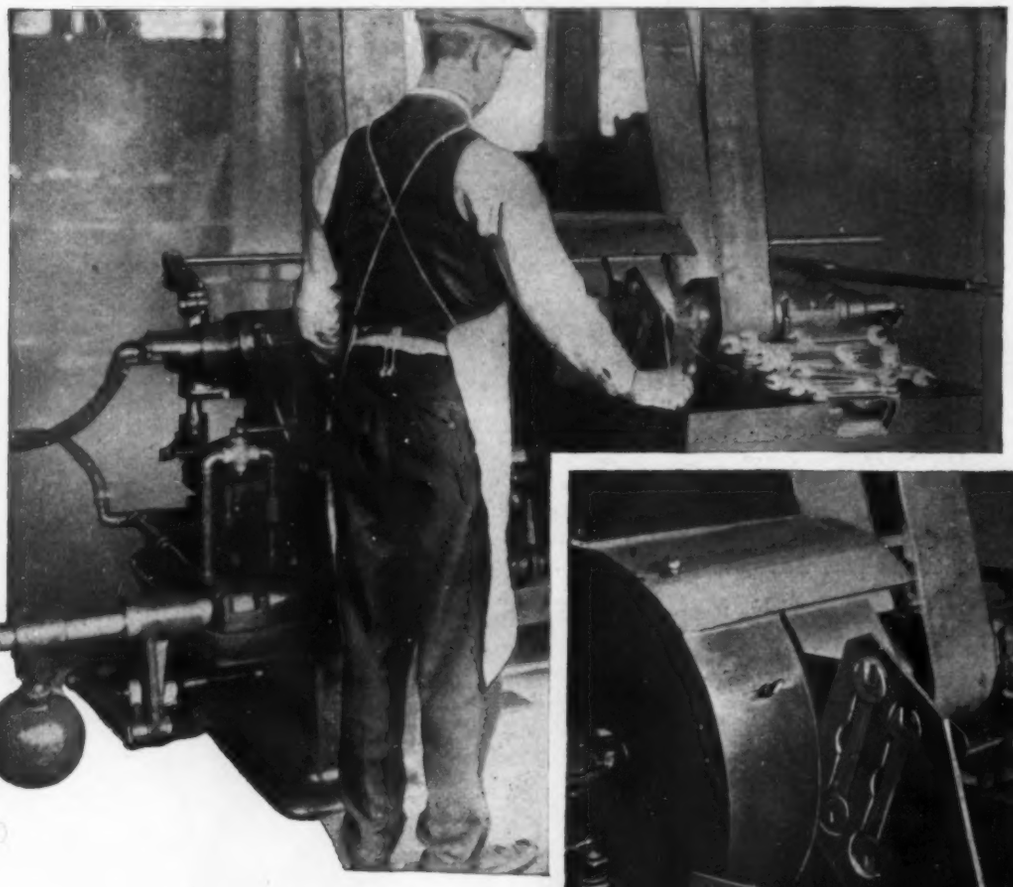
Geometric Style KD Die Head

Right from the Lead

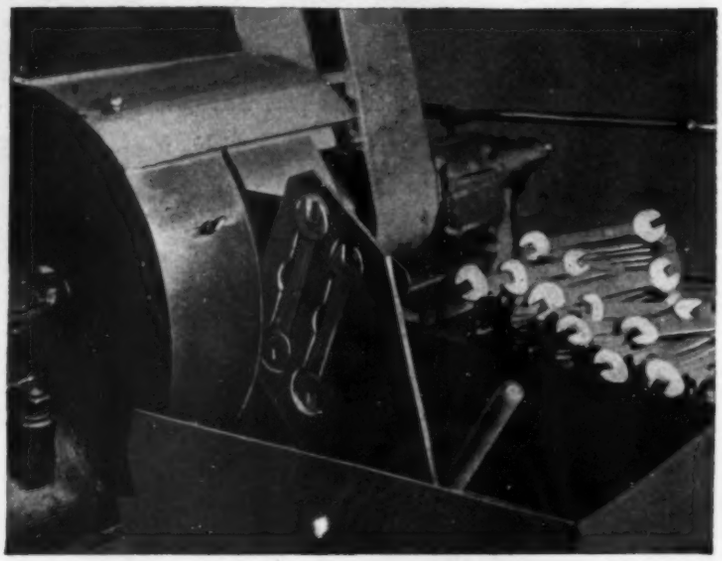
The Geometric Tool Company

(Westville Sta.) New Haven, Connecticut, U. S. A.

Another Remarkable Besly Performance



BESLY
CHICAGO



Remarkable performances on flat grinding work are the usual thing with Besly Wet Disc Grinders.

The illustration shows a No. 6-I type machine turning out open end wrenches at the rate of from 200 to 400 per hour, depending on the size. The wrenches range from 5 to 10 in. long and 5/16 to 7/16 in. thick. Parallel faces are ground on two sides of two wrenches at a time. About 1/64 to 1/32 in. of stock is removed from each side. The lower illustration shows the convenient method of supporting the work in the grinder with power oscillated fixture.

Whatever your flat grinding problem may be, we can undoubtedly materially reduce your costs. Ask us for further information.

The Besley-Titan Spiral Abrasive Disc

(Patent Applied for)

It has a very unusual shearing effect that greatly increases the cutting quality; and the clearance grooves prevent friction and excessive heating by enabling the grindings to escape. This means better work produced, at greater speed and with less effort. Send us information as to your work—and give your disc grinder operator a chance to use this new style disc.

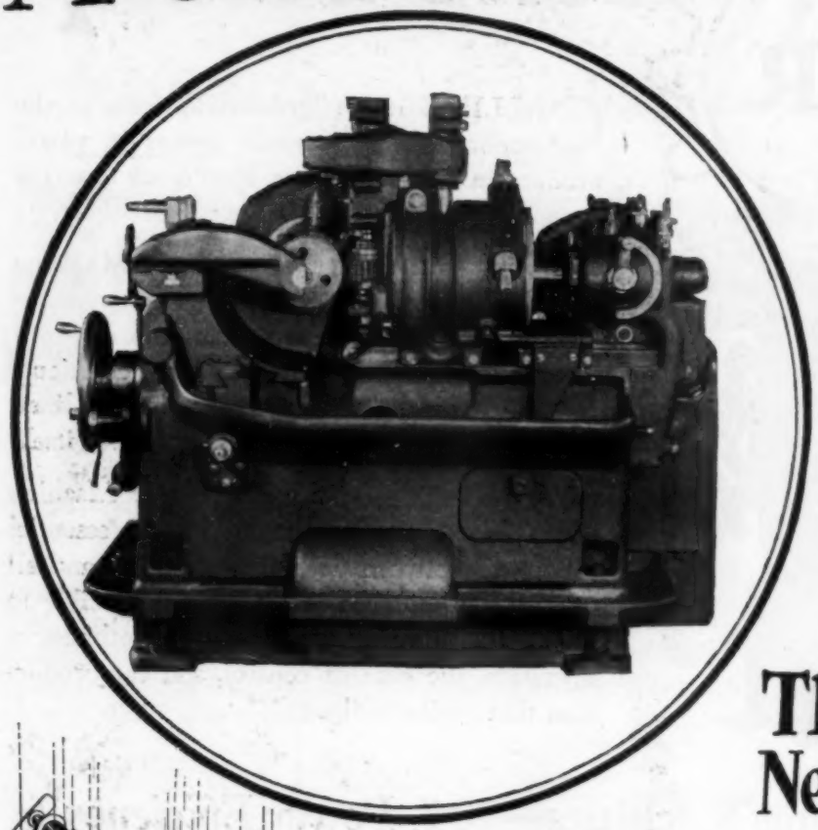
Charles H. Besly & Company

119 No. Clinton St., Chicago, Ill., U. S. A.

Originators of Disc Grinders

Works at Beloit, Wisconsin

A Continual Stream of Gears



Spur Gears
Helical Gears
Worm Wheels
Sprocket Wheels
Spline Shafts
Worms

The 5-AC New Model

Lees-Bradner Gear Generators

These extremely universal hobbers handle the above variety of work with equal efficiency, made possible by

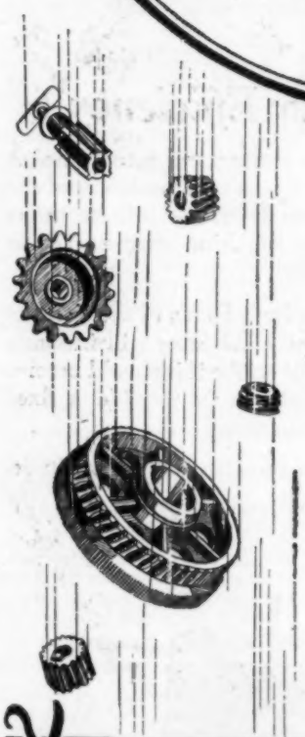
The COMPOUND INDEX, found only on Lees-Bradner Hobbers.
The AUXILIARY HIGH SPEED CUTTER SPINDLE.
The POWER WORM WHEEL INFEED.

The following important features are incorporated in the 5AC New Model.

POWER QUICK RETURN TO WORKSLIDE
CENTRALIZED CONTROL
INSTANT CUTTER REVERSE
GREATER COOLANT CAPACITY

Users of the 5AC are getting fast production together with the highest quality of product.

Circulars on request.



The Lees-Bradner Co.

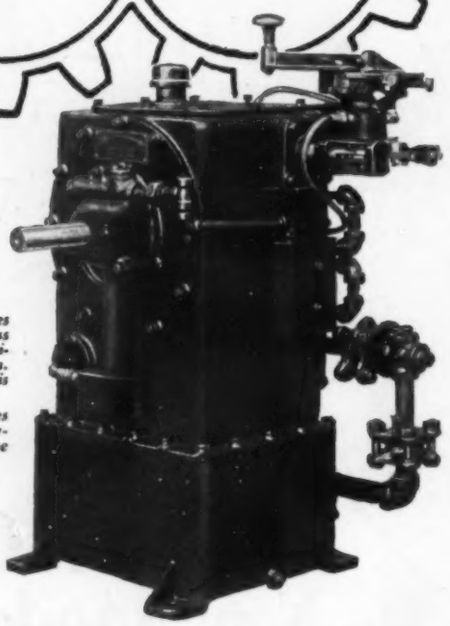
Cleveland, Ohio

GEAR HOBBERS
GEAR GRINDERS
GEAR TESTERS
THREAD MILLERS

IT ISN'T "OILGEAR"

"The Pump

OILGEAR



The Oilgear Pump gives a steady, pulsationless flow of oil instantly variable in speed or direction. The power efficiency is 95%.

The Oilgear Pump gives the advantages of hydraulic power without the disadvantages.

CALLING it the "greatest advance in the application of hydraulic power in years" production executives have been quick to accept the many advantages of "Oilgear."

Oilgear *is* different. An Oilgear Machine comes to your shop ready for work. It requires nothing more than connection to a constant speed source of power. It needs no additional pumps, accumulators or pressure supply lines. Each Oilgear Machine is a complete unit in itself.

An integral part of each Oilgear Machine is the Oilgear Pump. The pump is the essential difference between Oilgear Equipment and all others. Without the pump it is impossible to obtain the power efficiency, the smoothness of operation, the ease of control, and the production that typify "Oilgear."

OILGEAR Broaching Machines—90% *Power Efficiency*

The output of this machine is limited only by the operator's speed and the ability of the cutting tool to withstand the speeds obtainable. Yet the steadiness of the Oilgear Broaching Machine permits the use of speeds that would result in tool breakage on others. The Superintendent of a nationally known plant says:

"I saved the price of the machine in the first month's operation by practically eliminating broach breakage."

The safety valve may be set to unload at any predetermined pressure, thus preventing damage to cutting tool or work. The amount of pull is at all times visible to the operator.

The speed variations of the cutting and return strokes are unlimited. Either may be varied independently of the other by simply turning a screw. ***With the infinite number of speeds available, the machine may be set so that the operator is never idle.***

Control is arranged to leave both hands of the operator free to serve the machine. The hand lever will instantly stop the ram at any point in the stroke if it should become necessary. Adjustable automatic stops provide a fixed length of stroke without overrunning.

Bulletins describing Oilgear Broaching Machines in detail will be sent at your request.

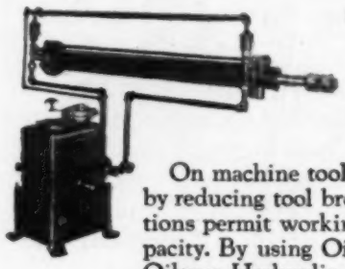
The No. 4 Oilgear Broaching Machine. Note the foot-pedal control that leaves the operator's hands free. The lever instantly stops the ram at any point of the stroke.

Basic Patent No. 1,468,395, issued Sept. 18, 1923

UNLESS IT HAS THE "OILGEAR" PUMP

Makes the Difference"

The Varied Uses and Applications of "Oilgear"



Wherever a slow, powerful ram movement with accurately, variable speed control and rapid traverse is needed, "Oilgear" fills a long felt want.

On machine tool feeds the steady pressure makes a big saving by reducing tool breakage. The unlimited number of feed variations permit working the machine at all times at maximum capacity. By using Oilgear Feed and an Oilgear Pump driving the Oilgear Hydraulic Motor an old machine can be converted at low cost into an up-to-date tool.

On Straightening, Mandrel and Assembly Presses, "Oilgear" gives a squeezing pressure within exact limits without impact to cause breakage or set up strains in the material.

On Tunnel Kiln Pushers, control of Heavy Damper and Gate Valves and on Timed Conveyors "Oilgear" gives dependable accurate service.

The value of "Oilgear" on special applications of this kind is evidenced by the many manufacturers who now incorporate "Oilgear" as part of their product.

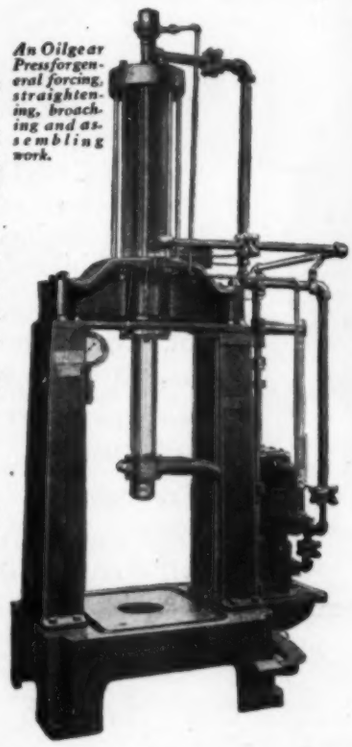
Oilgear engineers will be pleased to discuss the details of practical application of "Oilgear" to your plant or product.

"Oilgear" Presses

Nowhere is the worth of the Oilgear principle better exemplified than when applied to presses. Oilgear Straightening, Combination Broaching and Assembling Presses and Riveters are speeding up production in leading shops throughout the country.

On straightening work an Oilgear Press brings the ram to the work and from there builds up the pressure. There is no impact to cause breakage and as the ram never overrides the mark, greater accuracy is assured. Like all Oilgear equipment the safety valve can be set to unload when pressure builds up to the desired points. The ease of control and accuracy of Oilgear Presses bring work to the proper shape in a minimum of time.

If you use presses in your shop Oilgear engineers will be glad to go over the savings that Oilgear Presses can make for you.



An Oilgear Press for general forcing, straightening, broaching and assembling work.

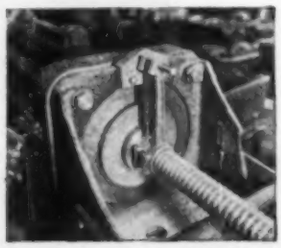
If you have a production problem ask Oilgear engineers

It will be time well spent to go over with Oilgear engineers the advantages that Oilgear can offer your plant. If you make mechanical equipment perhaps they can offer a use of "Oilgear" on your product that will place you in an advantageous position with your competitors.

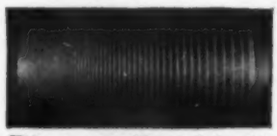
In the meantime send for descriptive bulletins of the type equipment in which you are interested.

THE OILGEAR COMPANY
659 Park Street
MILWAUKEE, WISCONSIN

How Industry Uses OILGEAR



Broaching connecting rods in a leading automobile plant.
Before installing the Oilgear machine this job required 31 hp. and a five foot draw per minute. Oilgear now does the same job at 10 feet per minute with but 10 hp. The power saving is 600%.



This cut on round bar stock shows the unlimited variations obtainable with an Oilgear Feed on machine tools. This is a decided advantage in that cut can always be made at the maximum capacity of the tool.

This Oilgear Axle Assembling Press materially speeds up axle assembly in this plant.
The large number of Oilgear machines in automotive shops attests the high production capacity of this equipment.

Send for the "OILGEAR" Catalog

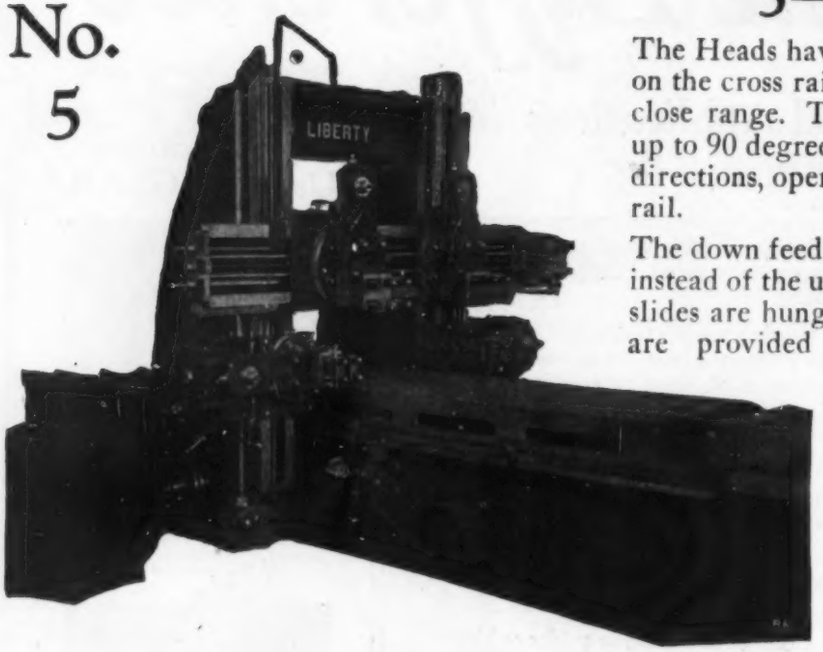
Every shop executive should have a copy of the Oilgear Catalog in his reference file. A line from you will promptly bring your copy.

Oilgear Hydraulic Equipment

PRESSES — BROACHING MACHINES — TRANSMISSIONS — PUMPS

The *New* LIBERTY PLANER

No. 5—The Heads

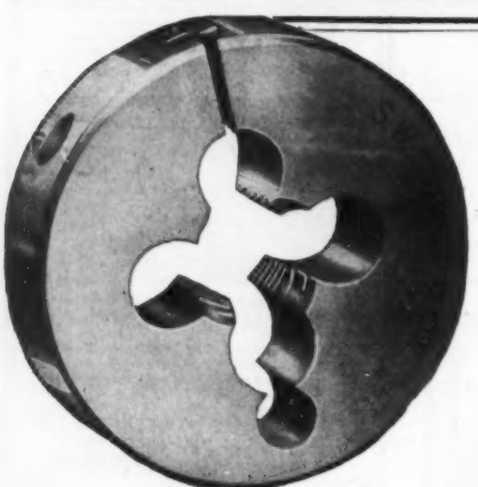


The Heads have long and wide bearing surfaces on the cross rail and are made right and left for close range. They are graduated for swiveling up to 90 degrees and have automatic feeds in all directions, operative from either end of the cross rail.

The down feed screws under strain are in tension instead of the usual method of construction. The slides are hung on ball bearings. Binder screws are provided on both saddles and slides. Micrometer adjustments are provided on all vertical and horizontal feed screws.

The New Liberty will cut operating costs and increase your planer efficiency in a startling manner. Get the new bulletins and—talk to the "Liberty Man."

The Liberty Machine Tool Co., Hamilton, Ohio



CARD
Round Adjustable
DIES

Isn't this real satisfaction?

Users of CARD Quality Taps and Dies are generally so well satisfied with service rendered and results obtained that orders are repeatedly placed without even a competitive bid.

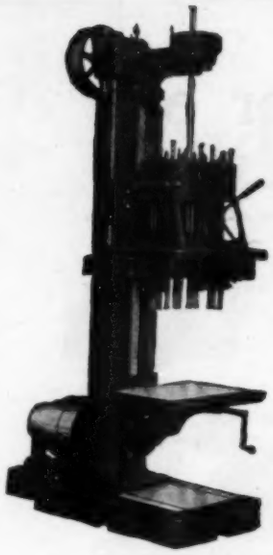
Some of these customers have used CARD Tools for over 30 years with satisfactory results — a lasting tribute to CARD Quality Products.

No better service—no better tools can be had at any price.

Try them and become a CARD customer.

Send for Catalog 31 and make your selection. All sizes are stocked for immediate shipment. CARD Dies are hard workers, they never lay down.

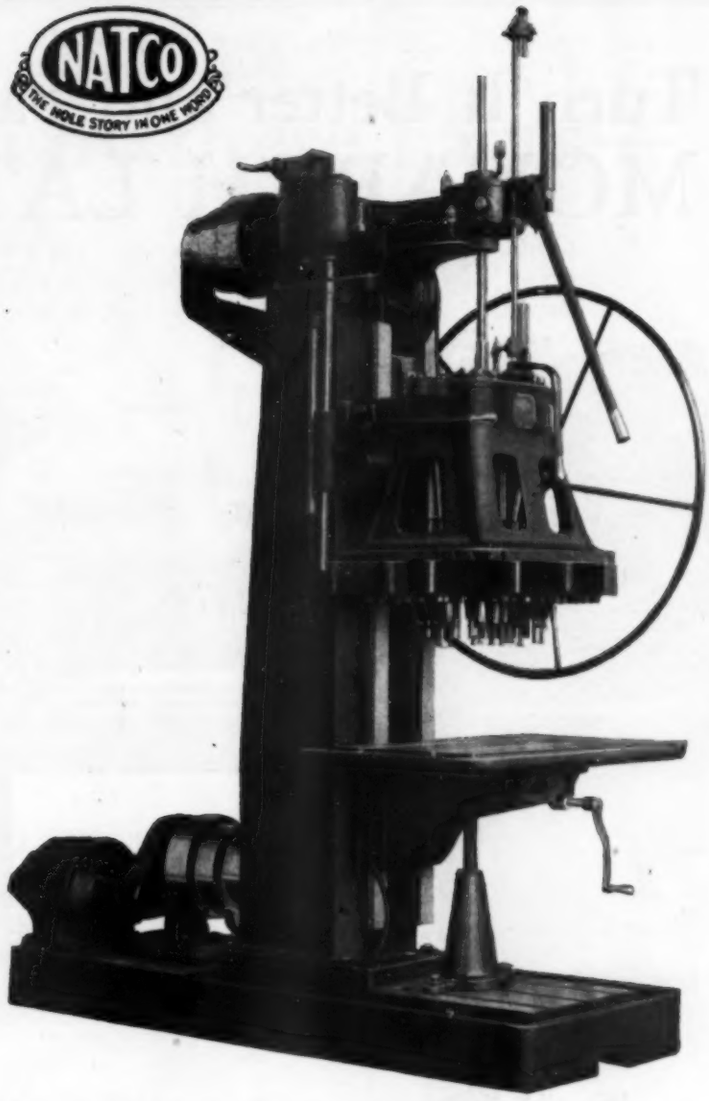
S.W. CARD MFG. CO.
DIVISION OF UNION TWIST DRILL CO.
MANSFIELD, MASSACHUSETTS, U.S.A.



No. 13 NATCO

NATCO
THE WHOLE STORY IN ONE WORD

IMPROVED



The New Model C13 NATCO

Changes That Make This a Better Machine

1. The Base has been made two inches deeper and enlarged to take direct motor drive as standard equipment.

2. The column has been strengthened all over and three inches has been added to the width of the ways.

3. The head is now equipped with taper gibs for finer adjustment.

4. A larger work table has been added with center support and two "T" slots for clamping fixtures or work.

5. The neck is larger and the feed mechanism has been improved.

6. As an additional factor of safety two counterweight cables are now used instead of one.

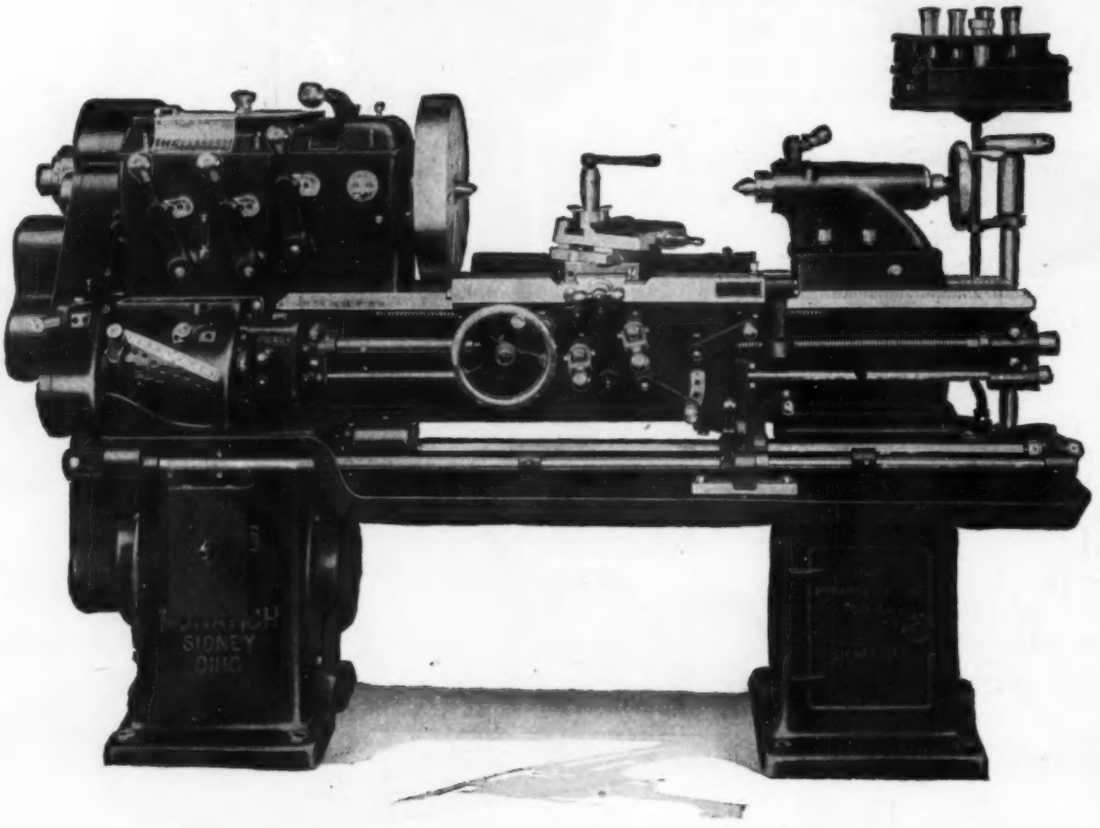
7. To prevent injury to the operator and to make the rapid traverse of the head easier, a rim has been added to the pilot wheel.

8. The Spindle Screw Adjustment and Locking Device is now standard and the arms are clamped to the head flange with two "T" bolts instead of one.

THE NATIONAL AUTOMATIC TOOL CO.

RICHMOND, INDIANA

Turn It Better and Faster on MONARCH LATHES



16-in. x 6-ft. Monarch Helical geared ball bearing self-contained motor drive lathe.

You Will Turn It Better—

For the reason that Monarch Helical geared lathes produce uniformly smooth work, free from gear tooth marks. Monarch lathes are as accurate as lathes can be built.

You Will Turn It Faster—

as Monarch lathes are heavier than other lathes of equal swing, and properly distributed weight, size of bearings, spindles, etc., does have a lot to do with the amount of metal removed.

Operators change spindle speeds, engage and disengage feeds, and operate all controls on Monarch Helical geared lathes is less time than on other lathes. Fast speed and feed controls reduce production costs.

Prolong Prosperity with Modern Machine Tools.

Modern Equipment Cuts Costs.

THE MONARCH MACHINE TOOL COMPANY
SIDNEY, OHIO

Judge by these Facts—

Less than a year ago a prominent motor car manufacturer bought one Hydraulic Crank Pin Grinder; within four months they ordered FOURTEEN additional ones.

Another motor manufacturer ordered one of these machines and bought TEN more inside of three months.

Still another prominent automobile manufacturer bought a machine of this type and within two months ordered TEN more.

In addition, there are from ten to twelve other motor manufacturers using from ONE to SIX of these machines.

This record of less than a year proves conclusively that these machines are real producers and cost reducers.

Your request will bring complete information.

LANDIS TOOL CO.
Waynesboro, Pa.

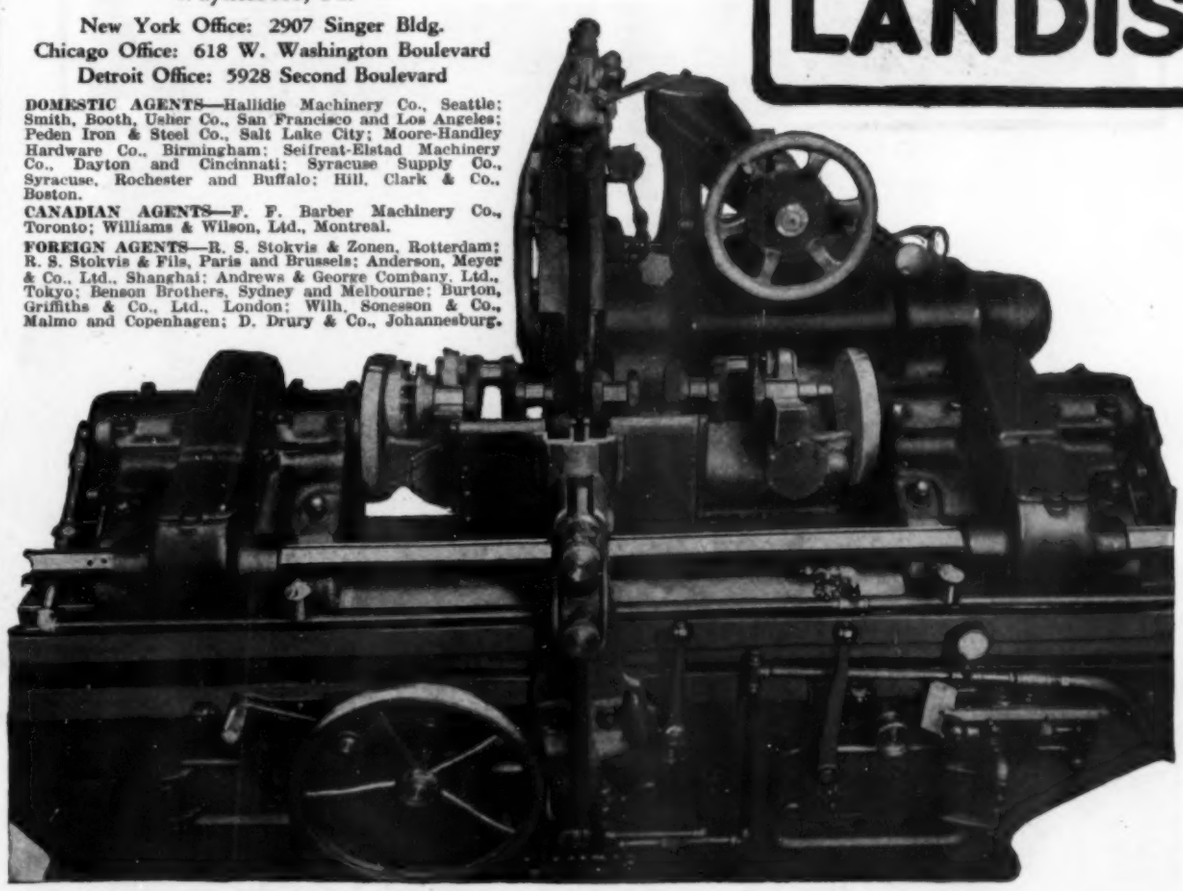
New York Office: 2907 Singer Bldg.
Chicago Office: 618 W. Washington Boulevard
Detroit Office: 5928 Second Boulevard

DOMESTIC AGENTS—Hallidie Machinery Co., Seattle; Smith, Booth, Usher Co., San Francisco and Los Angeles; Peden Iron & Steel Co., Salt Lake City; Moore-Handley Hardware Co., Birmingham; Seifreat-Elstad Machinery Co., Dayton and Cincinnati; Syracuse Supply Co., Syracuse, Rochester and Buffalo; Hill, Clark & Co., Boston.

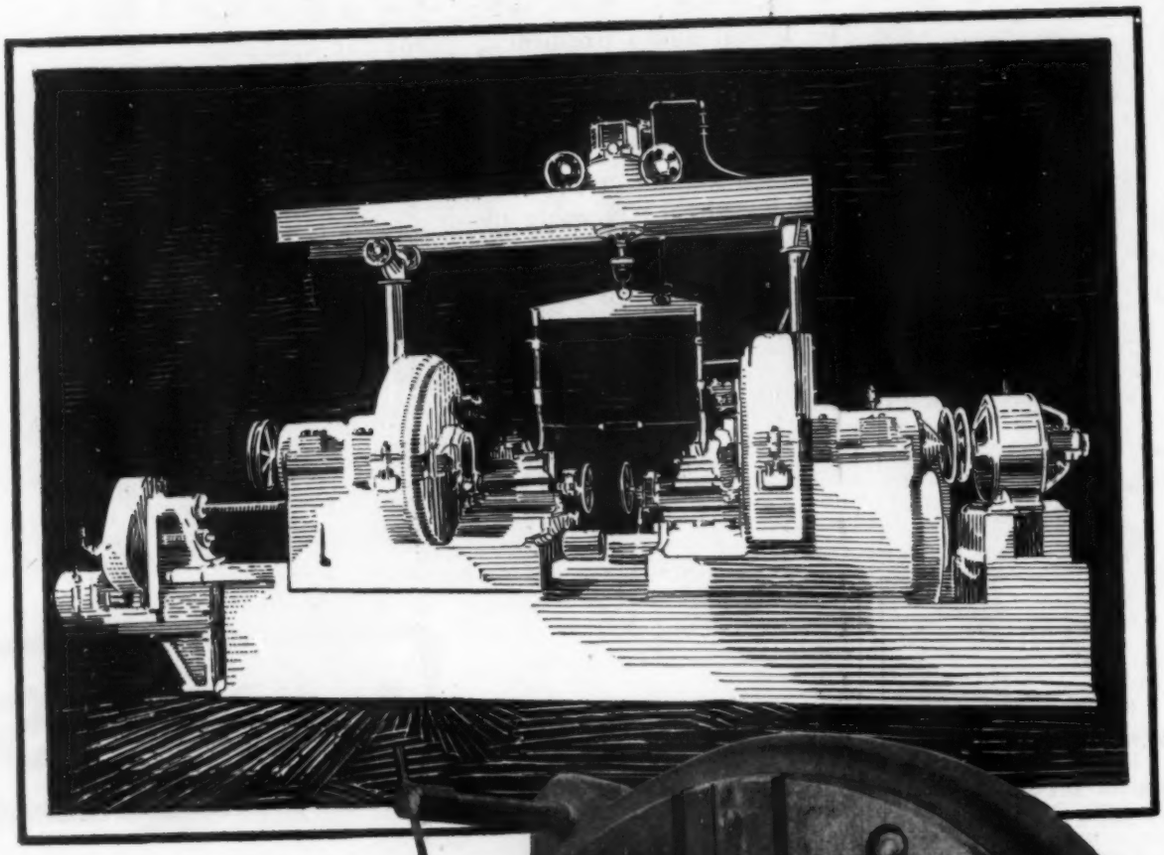
CANADIAN AGENTS—F. F. Barber Machinery Co., Toronto; Williams & Wilson, Ltd., Montreal.

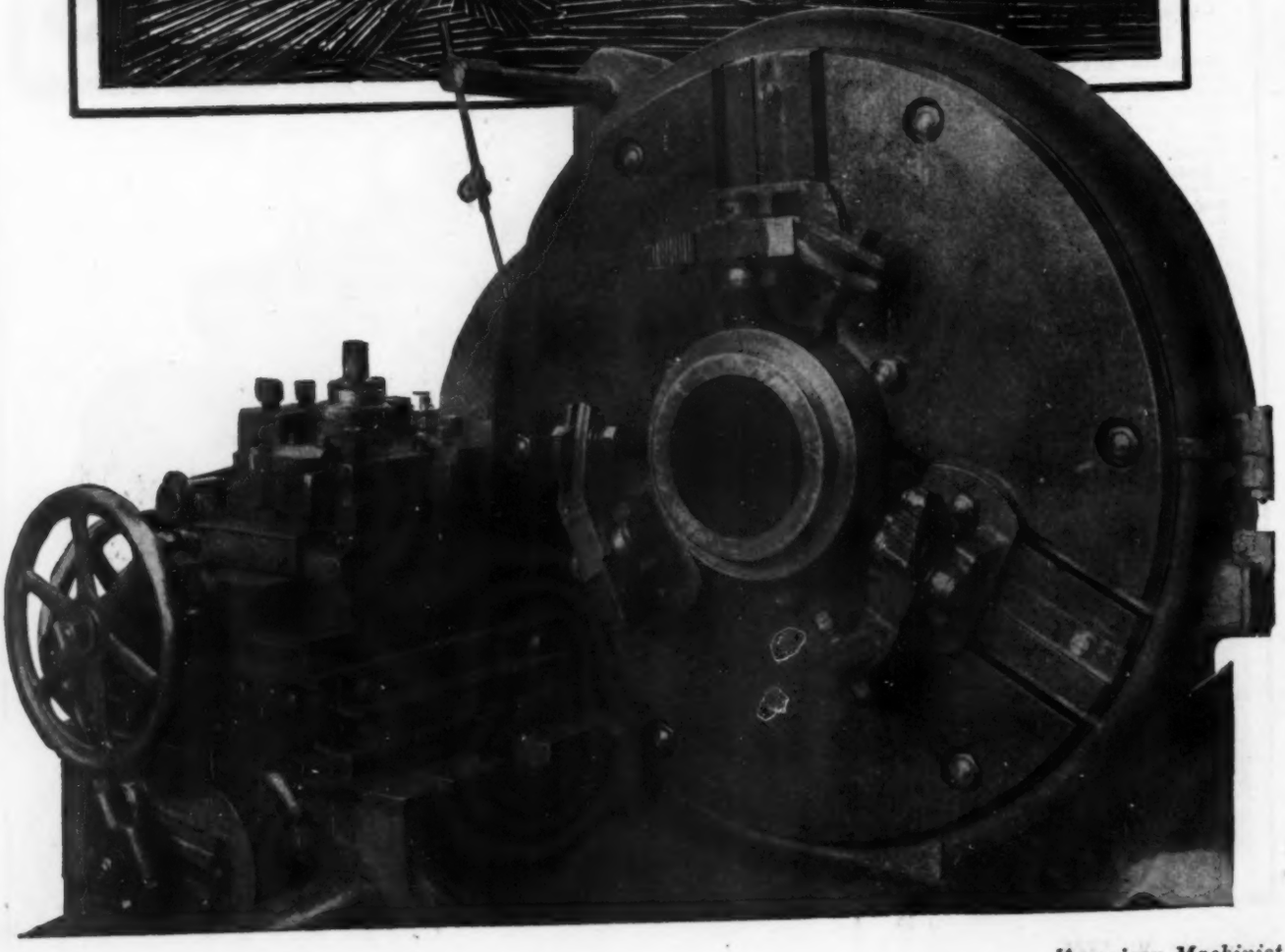
FOREIGN AGENTS—R. S. Stokvis & Zonen, Rotterdam; R. S. Stokvis & Fils, Paris and Brussels; Anderson, Meyer & Co., Ltd., Shanghai; Andrews & George Company, Ltd., Tokyo; Benson Brothers, Sydney and Melbourne; Burton, Griffiths & Co., Ltd., London; Wilh. Sonesson & Co., Malmo and Copenhagen; D. Drury & Co., Johannesburg.

LANDIS



In spite of higher price,





the best run railroads in the world continue to buy

SELLERS
Car Wheel Lathe

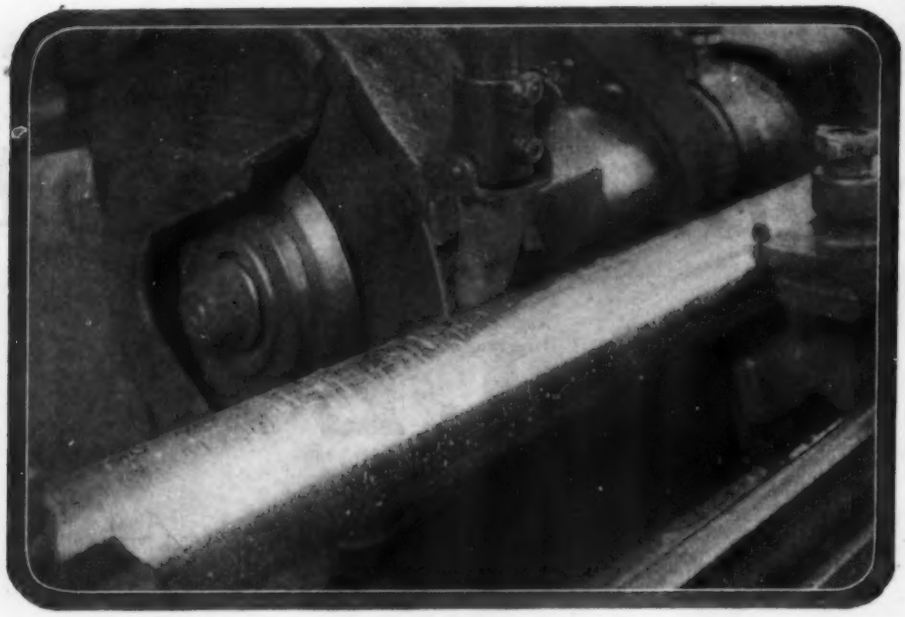
Because it is a production machine, and it keeps on the job so steadily year after year that it is the cheapest in the end. This is not a theory—it's a fact.

For instance, after eight years of three-shift service—equal to twenty-four years of ordinary running—one of these machines was overhauled, and the main spindle bearings needed no attention. They still showed the original scraper marks.

Only the best of workmanship and design could produce that result.

But that is not all. The big thing about the SELLERS Lathe is the amount of work it does.

WILLIAM SELLERS & CO. INCORPORATED
Philadelphia, U.S.A.



Doubling Production on Shaft Grinding

WITH the installation six years ago of a Norton 14 in. x 96 in Cylindrical Grinding Machine came double production over the former methods, greater accuracy and a consequent saving in production costs.

The shafts are hammered steel, heat treated; 6 feet long by 3 1/16 in. diameter and are held to limits of —.001 in. = + .000 in.

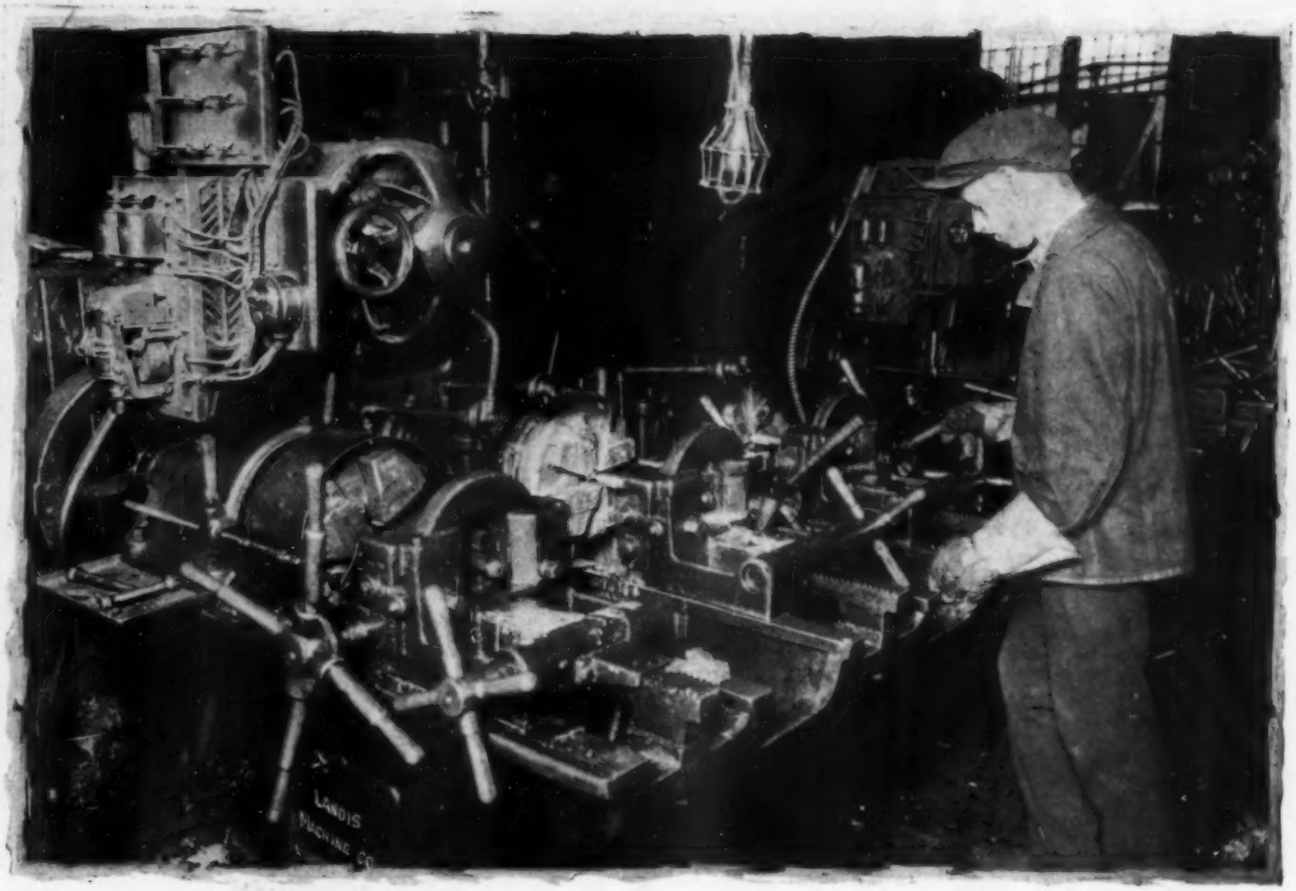
The wheel is a Norton vitrified 36-J, Alundum.

NORTON COMPANY, WORCESTER, MASS.

New York Chicago Detroit Philadelphia
Cleveland Syracuse Hartford

NORTON
GRINDING MACHINES

M-152A



STAYBOLTS—

120 Per Hour

FAST work you will admit but this production on one inch rigid staybolts is not at all unusual for a Triple Spindle LANDIS Threading Machine.

When you stop to consider, however, that the above installation has been in service over seven years and used on all classes of work, you will see the reason why the majority of railroads prefer LANDIS Threading Equipment.

It pays to investigate the LANDIS line before specifying equipment for your threading needs.

LANDIS MACHINE COMPANY, Inc., Waynesboro, Pa.

Detroit Office: 5928 Second Blvd.

DOMESTIC AGENTS: Marshall & Huschart Machinery Co., Chicago, Ill.; Marshall & Huschart Machinery Co. of Indiana, Indianapolis, Ind.; Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; R. B. Whitacre & Co., St. Paul, Minn.; Hamilton Machinery Co., Chattanooga, Tenn.; Young & Vann Supply Co., Birmingham, Ala.; Woodward, Wight & Co., New Orleans, La.; Jos. T. Ryerson & Son, Houston, Texas; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.; Salt Lake Hardware Co., Salt Lake City, Utah; Harry M. Euler Co., Portland, Ore.; Hallidie Machy. Co., Seattle, Wash.; Hallidie Co., Spokane, Wash.; Herberts Machinery & Supply Co., San Francisco, Calif., and Los Angeles, Calif.; R. S. Armstrong & Bro. Co., Atlanta, Ga.

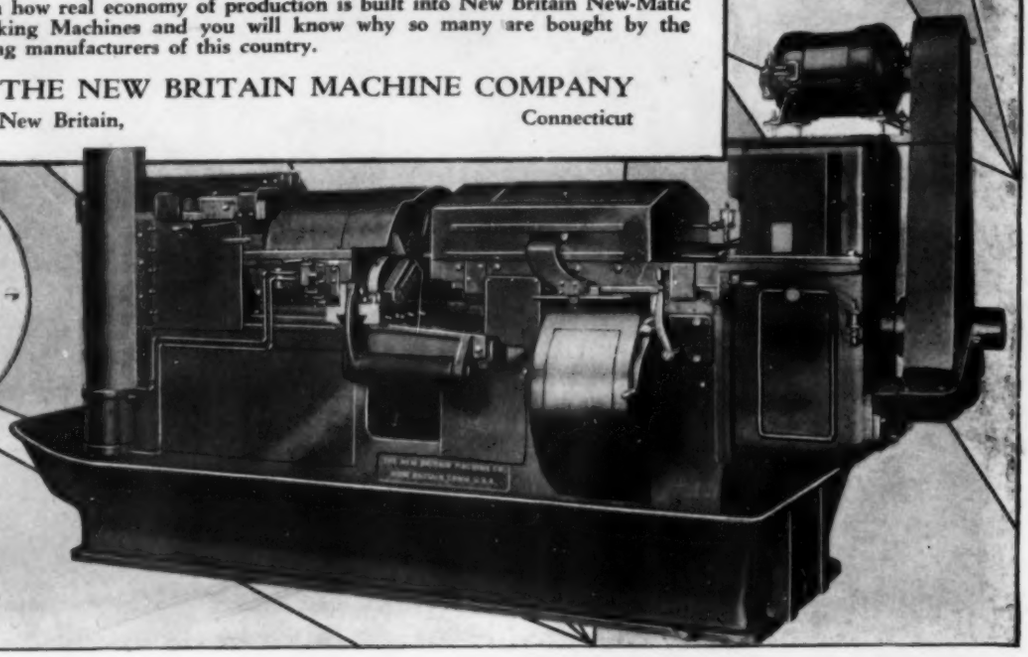
CANADIAN AGENTS: Canadian Fairbanks-Morse Co., Toronto and Montreal.
FOREIGN REPRESENTATIVES: Benson Brothers, Ltd., Sydney; Schuchardt & Schutte, Berlin, Vienna, Prague, Warsaw; R. S. Stokvis & Zonen, Rotterdam, Brussels, Soerabaya; M. Almeida & Cia, Sao Paulo, Rio de Janeiro; Alfred Herbert, Ltd., Coventry, Calcutta, Osaka; Burton Fils, Paris; D. Drury & Company, Johannesburg.

NEW BRITAIN
Super-Production
NEW-MATIC CHUCKING MACHINES
(Work Rotating Type)

Learn how real economy of production is built into New Britain New-Matic Chucking Machines and you will know why so many are bought by the leading manufacturers of this country.

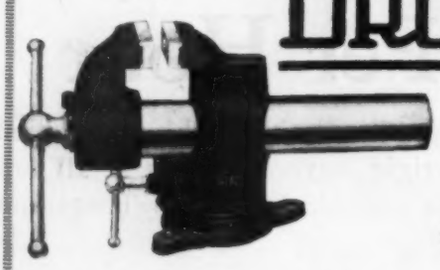
THE NEW BRITAIN MACHINE COMPANY
New Britain, Connecticut

"NEW BRITAIN" NB NEW-MATIC



For Efficiency—Rigidity—Durability

Buy **The DROPFO VISE**



Made entirely from Drop Forgings

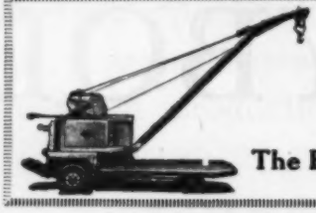
A large Automobile Manufacturer now using 250 Four-inch DropFo Wedgelock Swivel Vises have effected a saving of 15 minutes in time in each 8-hour day due to the simple and positive Wedgelock principle. The Vise pays for itself through this feature alone in thirty days.

Introductory prices now effective for a limited time only.

Size	Jaw Opening	Weight	Introductory Prices	
3 in.	5½ in.	23 lbs.	$14.00	Less 25% and 10% on swivel type.
4 in.	6 in.	35½ lbs.	17.00	
4½ in.	7 in.	45 lbs.	24.00	Less 25%, 10% & 10% on stationary type.
5 in.	8 in.	52½ lbs.	30.00	

Kindly mail your order direct. We guarantee the product.

THE FULTON DROP FORGE COMPANY
19 W. LIBERTY STREET CANAL FULTON, OHIO



Electric Industrial Crane Truck
One of 25 Types
Each Built for Special
Lift and Carry Service
Request Catalog 811
The Elwell-Parker Electric Co.
Cleveland, Ohio

DICKINSON DIAMOND TOOLS

for truing Large, Coarse and Hard Grinding Wheels, give the greatest amount of service with a minimum of wear on the diamond. The name "Dickinson" is stamped on all tools. We are proud of a long record of satisfactory service.

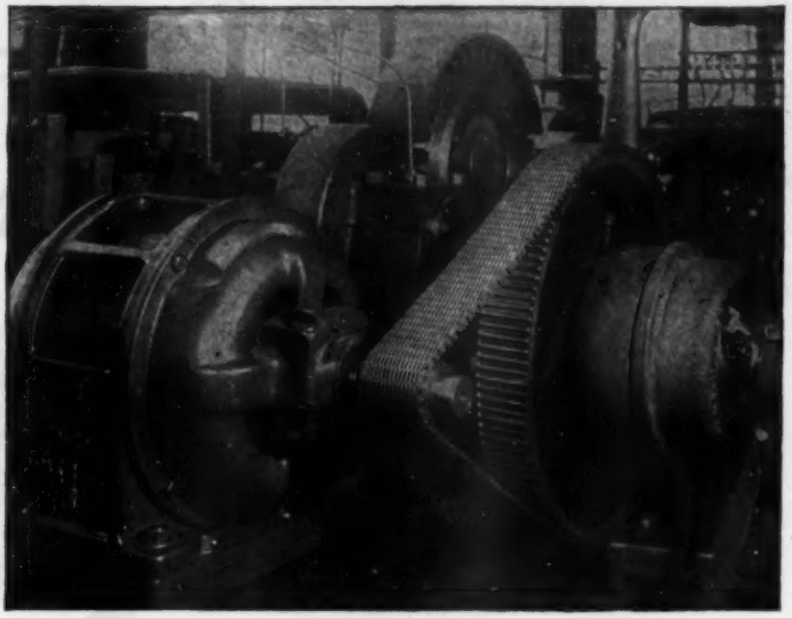
THOS. L. DICKINSON, 38 Gold Street, New York City
Successor to John Dickinson Established 1700

Deep Drawn Metal Stampings

As specialists in doing every sort of deep drawn metal work, we solicit your most difficult and intricate work of this kind.

We will assist in solving your specialized problems. Send us blueprints or samples.

PRESSED METAL DEPARTMENT
Rockwood Sprinkler Co. of Massachusetts
General Manufacturers of Pressed Steel Products
Worcester, Mass.
London Office: 147 Queen Victoria St., E. C. 4



Greater SILENT CHAIN Adaptability

to the various requirements of

FACTORY AND MACHINERY DRIVES

is announced by the makers of

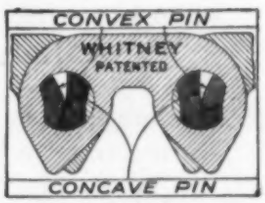
"Whitney" Silent Chain Drives

For drives to transmit heavy loads at moderate speeds the 70% greater joint bearing area of this type assures greater dependability and longer life.

For drives to serve spinning frames, twisters and other machinery where high speeds and short centers are required, this type resists wear and requires minimum lubrication.

"Whitney" Double Bearing Pin and Bushing Joint

"Whitney" covers the silent chain field with two distinct types of chain



"Whitney" Rolling Joint

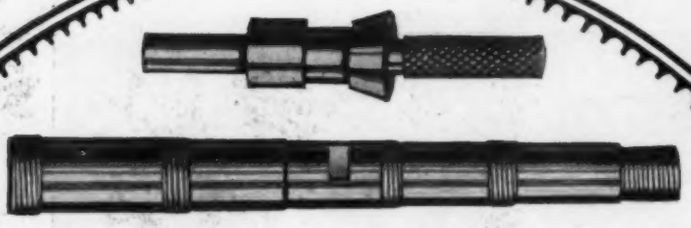
Let our engineers fit the drive to the job

THE WHITNEY MFG. CO., Hartford, Conn.

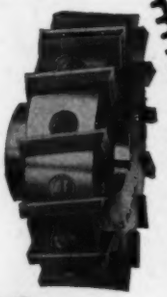
SALES AND ENGINEERING OFFICES

NEW YORK	BOSTON	PHILADELPHIA	SYRACUSE	CHICAGO
L. C. Biglow & Co., Inc.	The Whitney Mfg. Co.	The Whitney Mfg. Co.	George McPherson	The Whitney Mfg. Co.
250 W. 54th St.	711 Boylston St.	1505 Race St.	201 Norwood Ave.	549 W. Washington Blvd.
PITTSBURGH	**CLEVELAND**	**DETROIT**	**SAN FRANCISCO**	**SEATTLE**
Pittsburgh Gear & Mach. Co.	Smith Power Transmission Co.	The Whitney Mfg. Co.	A. H. Coates Co.	A. H. Coates Co.
27th & Smallman Sts.	1218 Ontario St.	2-240 General Motors Bldg.	615 Howard St.	1115 East Union St.

CHAINS AND SPROCKETS FOR POWER TRANSMISSION



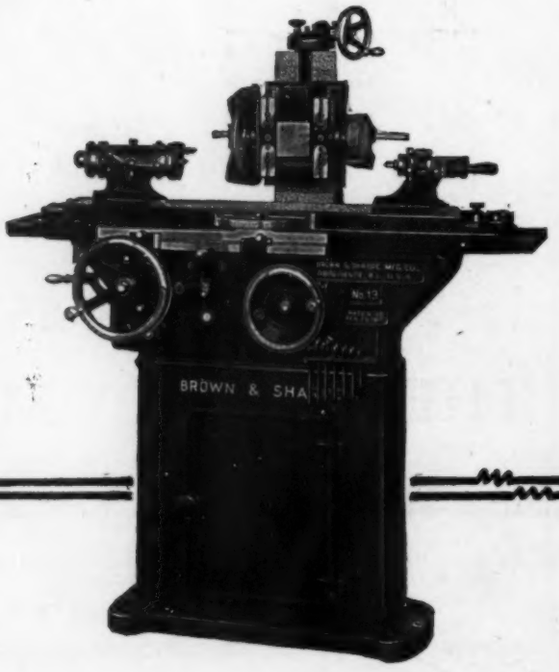
You can grind *all* of these pieces on *one* machine



Taper, cylindrical, internal, face, and all kinds of cutter and tool grinding come within the remarkably broad range of the

Brown & Sharpe No. 13 Universal and Tool Grinding Machine

Let our representative tell you how this machine can reduce costs in your grinding department.



Six attachments are offered for use with this machine for many unusual types of grinding. With these attachments available the machine becomes a grinding unit with a capacity that is almost unlimited for handling varied work.

"Cut-ability" shows up in the chips

Brown & Sharpe Products

Milling Machines
Grinding Machines
Gear Cutting Machines
Screw Machines
Cutters and Hobs
Machinist's Tools
Gears Cut to Order

Send for this Catalog

The Brown & Sharpe No. 30 Small Tool Catalog describes over 1500 sizes and styles of Cutters and Hobs and contains considerable cutter information. You should have a copy for reference purposes. If your dealer cannot furnish a copy, write us direct.

Judging from the chips, these cutters seem to be doing their part in keeping milling costs low. Here are the facts:

Two Brown & Sharpe opposed Helical Mills and two Single Side Milling Cutters are combined to take the cut. They are shearing out 25½ cubic inches of cast iron per minute and showed a production increase of 100% when they replaced a former set-up.

The profits in your milling department are measured by the "cut-ability" of your cutters. In the plants where "rock-bottom milling costs" is the watchword, you'll find much of the cutter equipment stamped Brown & Sharpe.

BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

Reach Out!

"We know that we must reach out for all the equipment information we can get in order to keep our plant up to date."

The President and General Manager of a nationally-known company remarks thus in his discussion of machine replacements in a recent issue of the *American Machinist.*

Thousands of shop executives and engineers reach out all through the year to the pages of the *American Machinist* for guidance in methods, for facts and tips about equipment.

And they find that the value of the *American Machinist* in this respect comes to a climax each six months with the Semi-Annual Shop Equipment Review and Catalog Number.

Here all the Shop Equipment News of the past half-year is combined and classified. Here the manufacturers give a complete condensed catalog of their most modern products.

The coming Semi-Annual Review and Catalog Number will stand you in good stead for months after its date of issue, as a live encyclopedia of facts about new machines, tools, supplies, materials.

Note down the date—

January 20, 1927

"Take this Mike f'r instance"

"If y' want t' know why I stick t' Starrett Tools you'll find some mighty good reasons right in this No. 230 Mike. Did y' ever put y'r hands on a Mike with a prettier hang or a nicer feel under your fingers? An' look at that cut out back o' th' anvil. Comes in handy in lots o' tight places. Y' can always count on Starrett t' give y' something a little different, an' better."

"Take it from me, Bud, y' can't do better'n t' ask the man behind th' counter t' make it a Starrett."

Starrett Micrometer Caliper No. 230

Ask us for a free copy of Catalog No. 23 "C."

THE L. S. STARRETT CO.

World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes—Standard for Accuracy

ATHOL, MASS.

454

Use Starrett Tools

The cover of the Monophone stand containing the dialing mechanism and ringer gongs, and also the transmitter-receiver unit are of Bakelite Molded. Made by Automatic Electric, Inc., Chicago.

For jobs like this Monophone Bakelite has many advantages

Lustrous black Bakelite molded simplified the production of this Monophone, and gave it lasting beauty of color and finish. The deep, Bakelite molded cover of the dialing stand is a single unit which comes from the mold a finished part requiring no subsequent machining nor finishing.

The shell of the transmitter-receiver is an assembly of three Bakelite molded parts, all being completely formed in the mold, including the threading of the shell. The strength and light weight of Bakelite, and its resistance to moisture and acids make it an ideal material for frequently handled parts such as these.

Our engineers and research laboratories are glad to cooperate with manufacturers in adapting the advantages and economies of Bakelite to their own particular needs. Some idea of the scope of Bakelite applications may be obtained from Booklet 34—"Bakelite Molded." A copy will be mailed upon request.

BAKELITE CORPORATION

247 Park Avenue, New York, N. Y. Chicago Office: 636 West 22nd St.

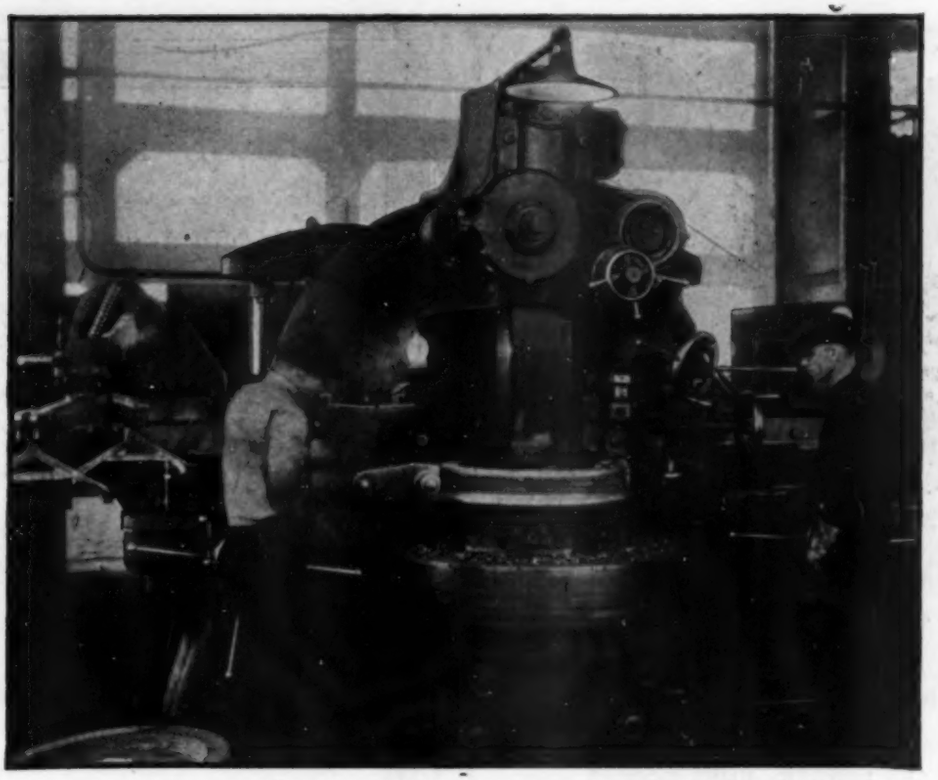
BAKELITE CORPORATION OF CANADA, LTD., 163 Dufferin Street, Toronto, Ontario, Canada

BAKELITE

REGISTERED U. S. PAT. OFF.

THE MATERIAL OF A THOUSAND USES

"The registered Trade Mark and Symbol shown above may be used only on products made from materials manufactured by Bakelite Corporation. Under the capital "B" is the numerical sign for infinity, or unlimited quantity. It symbolizes the infinite number of present and future uses of Bakelite Corporation's products."



The illustration shows Bethlehem Tool Steel in service turning steel wheels on high speed Wheel Boring and Turning Mill in one of our plants.

Bethlehem Tool Steels deliver the goods

OUR broad experience in making many millions of tons of steel each year, covering every kind of steel, has taught us how to obtain the finest and most uniform quality from a specific analysis.

Each grade of Tool Steel is put through severe performance tests in our own machine shops, mills, foundries and mines. If the steel comes through our test, it will deliver the goods for you.

BETHLEHEM STEEL COMPANY, *General Offices:* BETHLEHEM, PA.

District Offices:

New York Boston Philadelphia Baltimore Washington Atlanta Pittsburgh Buffalo
Cleveland Detroit Cincinnati Chicago St. Louis San Francisco Seattle Los Angeles Portland

***Bethlehem** Steel Export Corporation, 25 Broadway, New York City, Sole Exporter of our Commercial Products*

BETHLEHEM

Ajax Bull Bearing Alloy

Better than Babbitt

WEARS LONGER—RUNS COOLER

The Ajax Metal Company

ESTABLISHED 1880

PHILADELPHIA

NEW YORK CHICAGO BOSTON CLEVELAND

S-LESS T BRAND

OF

STAINLESS STEEL

Is Heat Treated to Maximum Efficiency

IT IS MADE AND TREATED BY

The First Steel Company in America

TO PRODUCE

STAINLESS STEEL

FIRTH-STERLING

STEEL COMPANY

McKeesport, Pa.

NEW YORK BOSTON HARTFORD
PHILADELPHIA CHICAGO CLEVELAND
DETROIT SAN FRANCISCO LOS ANGELES

W-13

Steel of Every Description

HAWKRIDGE BROTHERS COMPANY

303 Congress Street Boston, Mass.

Est. LUDLUM 1854

SEMINOLE

UNBREAKABLE

HEAVY DUTY CHISEL STEEL

UNPARALLELED FOR CHISELS, RIVET SETS, PUNCHES, DIES. WRITE FOR OUR INTERESTING BOOK ON TOOL STEELS

WE HAVE A SPECIAL TOOL STEEL FOR EVERY SPECIFIC PURPOSE

LUDLUM SPECIAL STEELS LUDLUM STEEL COMPANY

STEELS SPECIAL PURPOSES WATERVLIET-N.Y.-U.S.A.

HIGH SPEED, CARBON, ALLOY TOOL STEELS

OF QUALITY OUR SPECIALTY

Vanadium Alloys Steel Co.

Latrobe - - Penna

New York
Chicago
Philadelphia
Boston
San Francisco

BUNTING

PHOSPHOR BRONZE

BUSHING BEARINGS

360 Sizes—Always in Stock.

THE BUNTING BRASS & BRONZE CO.

TOLEDO

JESSOP'S STEELS

GENUINE SHEFFIELD

for Tools of Every Description

Branches and Stocks in All Principal Cities

William Jessop & Sons, Inc.

Head Office, 91 John Street, New York

IMPERIAL WELDING AND CUTTING **EQUIPMENT**

OXY-ACETYLENE PROCESS

A new mixing principle, accurate regulation of gases, eight torches in ONE—are exclusive IMPERIAL features. The Imperial Generator makes acetylene 2 to 4 cents cheaper per foot than you can buy it. Write for catalog.

Imperial Brass Mfg. Co., 1214 W. Harrison St., Chicago

CARPENTER CARPALOY

Corrosion-Resisting Steels

CARPALOY No. 1 (Stainless Iron)

CARPALOY No. 2 (Stainless Steel)

CARPALOY No. 3 (Rustless Steel)

In billets, hot-rolled bars, rings, discs, forgings, strips, cold-rolled and cold-drawn bars, polished drill-rods, etc.

Circular on Request

THE CARPENTER STEEL COMPANY
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The introduction of Phosphorous into its composition reduces any oxides dissolved therein and forms with the purified metals a most homogeneous and regular combination, the hardness, strength, toughness, rigidity and elasticity of which are completely under control.

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High Speed **Carbon**

Highest Quality—Best Practice

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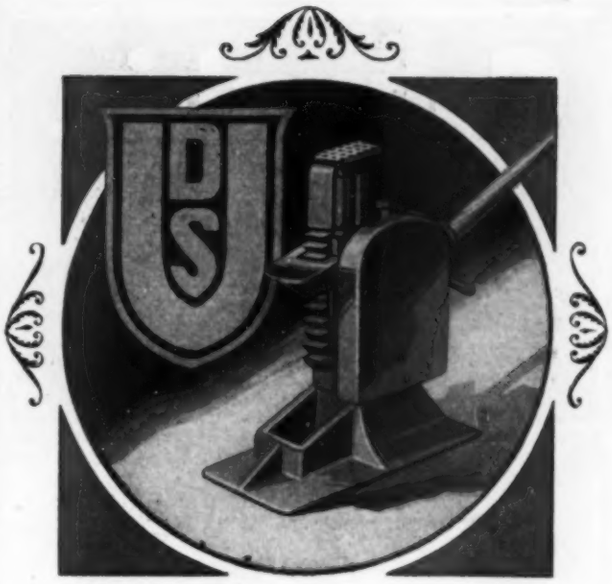

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UNION DRAWN STEEL *Company*

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TOOL STEEL

FINE STEELS made by the CRUCIBLE PROCESS

CLARITE HIGH SPEED STEEL
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COLUMBIA SPECIAL CARBON TOOL STEEL
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It pays to use Good Tool Steel.

COLUMBIA TOOL STEEL COMPANY

MAIN OFFICE AND WORKS, CHICAGO HEIGHTS, ILLINOIS

CHICAGO · DENVER · LOS ANGELES · PORTLAND · SAN FRANCISCO
CINCINNATI · DETROIT · MILWAUKEE · ST. LOUIS · SEATTLE
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As pioneers in the process of Electric Welding, we naturally bring an unexcelled experience and a wide range of models as noted for their economy of operation as they are for their high output.

Let us help with your welding problems.

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WELD IT WITH WELDIT EQUIPMENT SUPPLIES

Save 25% of Welding Gas!

Great corporations report savings in gas of 20 to 40 per cent and even more. The Weldit Gasaver acts as a rack for the torch, the weight of which shuts off the gas. When the torch is lifted the gas is released at the *same mixture* as before. Don't waste gas and adjusting time. Use the Gasaver.

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Approved by the National Board of Underwriters

Weldit Acetylene Company
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The Superior Quality of
"FEDERAL" WELDERS
Has Never Been Questioned

Complete line of electric spot, butt and seam welders, standard or special

The —Federal— Machine and Welder Co., Warren, Ohio

Recognized leaders in the development and production of resistance welding machines.

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Send Blueprints for Estimates

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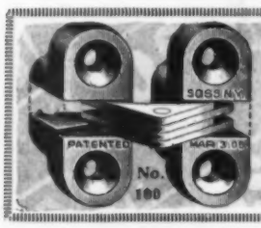
AMERICAN GAS FURNACE CO. PIONEERS IN 1878 LEADERS TO-DAY

Forges, Blowpipes, Gas Blast Burners, Furnaces and Heat Treating Machines for every industrial purpose.

Bulletin A.M.20 on request.

American Gas Furnace Co.
Office and Works: Elizabeth, N. J.



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INVISIBLE HINGES
Styles for every use of housewares, carpenters, cabinet makers, etc. Simple to design, easily installed and long lasting
See Sweet's Catalogue (pages 1578-9)
Soss Manufacturing Co., Inc.
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JOHNSON GAS FURNACES
for
Heat-Treating—Soldering—Metal Melting

JOHNSON GAS APPLIANCE CO.
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FRANKLIN DIE-CASTINGS

We cast in Aluminum, Tin, Lead and Zinc base alloys. Estimates made from samples, drawings, or blue prints. Send for booklet.

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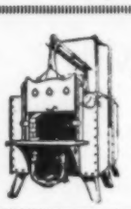

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and Furnace Room Accessories

The Strong Carlisle & Hammond Co.
Cleveland, Ohio

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THE BETHEL-PLAYER CO.
WESTBORO, MASS. U.S.A.
Precision Measuring Machines

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Write for Illustrated Booklet—FREE.

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TAYLOR SPOT WELDER

A combination foot-operated and motor-driven Taylor Spot-Welder, having capacity of No. 30 to 16 gauge, or No. 20 to No. 11. Six-speed gearbox. Special Taylor transformer. Carries the usual Taylor guarantee against electrical and mechanical defects. For production increase and economy, the Taylor catalog carries suggestions of practical, timely interest. Write for it.

THE TAYLOR WELDER CO., Warren, Ohio

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Send Blue Prints for Quotations

The J. N. Lapointe Company
New London, Conn.
Makers of Broaching Machines and Broaches

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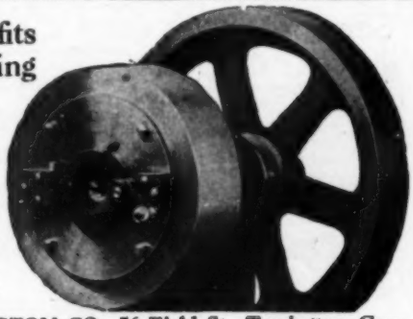
Manufacturers of Carbon and High Speed Steel Broaches

Made in 5 Sizes

Here's a Broacher Guaranteed to Increase Production 50% to 250%

So decisive have been the gains in production made by the J. N. Lapointe Company's Hydraulic Broaching Machines that we are able to *guarantee* increases of from 50% to 250% over the work formerly done by any broaching machine. There is no main reason for the phenomenal success of these machines but there are many contributing factors such as fast ram return, removable, chip pan, great power, flexibility and many other exclusive features. All are fully described in our Catalog No. 35, send for it.

Bigger Profits from Swaging



Are you taking advantage of modern machining methods? Swaging the Dayton way makes metal solid, tough and elastic. Daytons deliver from 2,000 to 6,000 blows per minute.

The details will convince you—get them.

THE TORRINGTON CO., 56 Field St., Torrington, Conn.
Excelsior Plant—Successor to Excelsior Needle Company

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when engines break down!

Emergency repairs day and night—call

UNDERWOOD'S
POWER PLANT REPAIR CREW

"CLARK" Tools Win by Comparison

CLARK AUTOMATIC DRILL

Switch "Handy to the Hand." Full line of electrically driven drills and grinders.

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OHIO *reliable* MOTORS

1/20 *to* 1/3 H.P.

The Ohio Electric & Controller Co. *Cleveland, O.*

We specialize in motors, 1/6 to 150 hp. constant and adjustable speed D.C.; squirrel cage and slip ring A.C.

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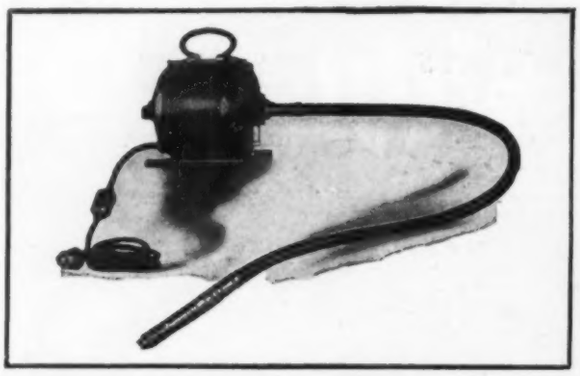

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Drilling, Reaming, Polishing, Tool and Die Making—Use S. S. White

Flexible Shaft Driven Tools

In dozens of shops, on hundreds of jobs, these portable motor driven tools are effecting vital economies.

Slow, cumbersome, costly hand finish is accomplished in a fraction of the time by the aid of the flexible shaft.

Look about your shop now—there are many operations that can be performed to better advantage and with greater profits.

May we show you the way in our 36-page catalog T gladly sent upon request.

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Built for PERMANENCE

Ruggedness—long life—ability to "stand the gaff"—*permanence* - - - these are some of the Master Standards of Quality built in every MASTER GUARANTEED MOTOR. Included in these motors are many other characteristics which cause an ever-increasing number of leading appliance manufacturers and jobbers to use them.

The Master Electric Co.
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MASTER GUARANTEED MOTORS

⅛ TO 7½ H.P. THE MASTER ELECTRIC CO. Dayton Ohio Less than 40°

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Rotary Files

Used with Strand Flexible Shaft Machines. Are giving excellent service.

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N. A. Strand & Co.
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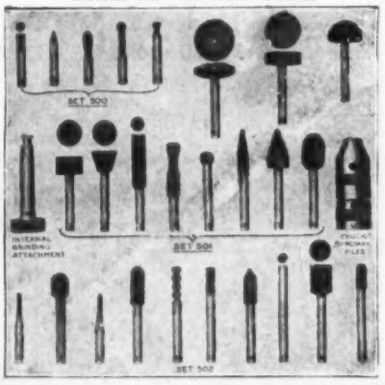
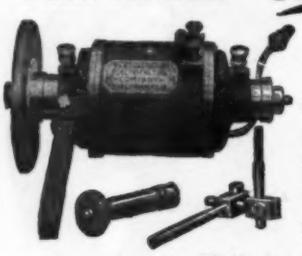
HIGH SPEED
HAND CUT ROTARY FILES



Sent on trial *The Cincinnati*



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Stay on the job

Hand and Screw Feed Drills, ¼ in. to 2½ in. Cap.
Tool Post Grinders, ¼ to 3 H.P.
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UNION Controllers

Specially designed for

Hoisting Machinery.
Metal and Woodworking equipment.
Electric Trucks and Tractors.
Mine Locomotives.
Pumps, Fans and Blowers.
All General-Purpose Motor Control applications.

Send for bulletin and detailed information.

UNION ELECTRIC MFG. CO.
Milwaukee, Wis. 20 Sales and Service Offices

Tirex Portable Cord Lasted Three years on a portable drill

TIREX NEVER KINKS

This is the record made by Tirex on a portable drill, on a portable valve grinder and on a portable drop light in an automobile and truck repair plant.
This company wrote us as follows:
"Tirex Cord outlasted all other kinds of cords that we tried and seems the best suited for our requirements."

This is unusual. So is Tirex. Try it.
Write for sample piece today.

SIMPLEX WIRE & CABLE CO.
Manufacturers
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The trend of industry is decidedly toward Cutler-Hammer Push Button Control. Merely a touch of the proper button right at the machine starts, accelerates, decelerates, regulates the speed or stops the motor as required. The controller is placed in any safe, convenient location. Saves time, affords better control and provides greater safety—a logical step in advance.

This booklet "Industry's Electrical Progress" puts into concise, interesting form the story of saving through modern motor control. Write for your copy today.

Motors by themselves are only brute force

The economies that electric power brings to industry depend on correct motor control

IT seems so simple—and yet in so many plants this basic truth is often neglected.

Motors by themselves are only brute force!

Engrave it on the minds of the men who design *your* equipment. Burn it into the memory of those who specify—those who buy. For today it is the battle cry in the fight to reduce manufacturing costs!

Every motor you put into service offers the opportunity of minimum operating expense. It can save in power costs. It can speed up production. It can save in labor—that major item of manufacturing burden. But you are trifling with opportunity if you leave these possible economies to chance—these economies that result not from the mere installation of motors, but from the production efficiency you are able to obtain through the perfect control of their brute force.

Competitive conditions today demand the accurate powering of equipment. Plan your drives considering the work to be done. That means the choice of motor control equipment first—choice of the type of control equipment that affords maximum speed of production—that ties in closest with the manual operations involved. The proper type of motor can *then* be selected to give maximum results.

Carry this story to the men of your plant! Have them check the motors you have in service. Like many other plants, you will find that modern motor control on many existing drives will pay for itself in a few months—and then add steadily to profits.

If you desire, Cutler-Hammer field engineers will gladly counsel with your plant men or consulting engineers to determine where savings may be obtained—to show them the latest control equipment available for every need. Their recommendations are based on more than thirty years' experience. This service is also offered for the planning of new drives, and their co-operation does not place you under any expense or obligation.

The CUTLER-HAMMER Mfg. Co.
Pioneer Manufacturers of Electric Control Apparatus
1230 St. Paul Avenue **Milwaukee, Wis.**

CUTLER-HAMMER

Industrial Efficiency Depends on Electrical Control

Rush!

How familiar that little word is to us!

How many times it comes hopping into our office—by ordinary mail, air-mail, telephone, telegram, messenger. Rush! Rush this gear or that, this size or that size, for there's been a break-down, operations are held up,—money is slipping away every moment; all for the lack of a gear. So please rush!

That's the sort of an order we like to get. For we pride ourselves on our speed in turning out *good* gears in a rush. We've built up quite some rep by doing just that. Hundreds of firms turn to us for gears, as automatically as a man shifts the gears of his car.

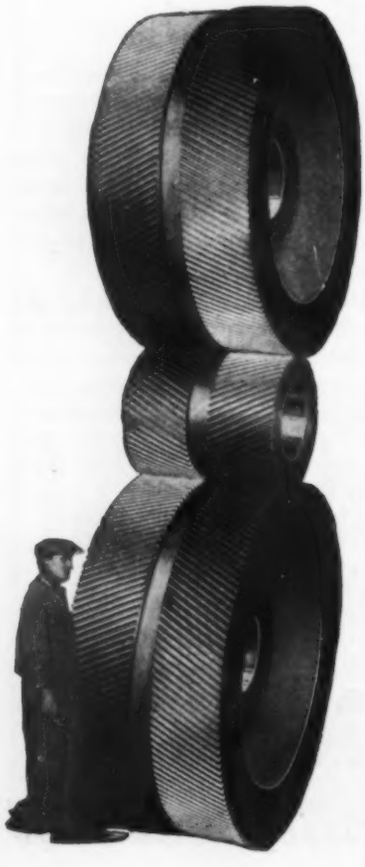
Try us, and you, too, will acquire that valuable habit.

Incidentally, have you a copy of our new Gear Book? Eighty pages, jamful of real dope on gears.

Phillie Gear

OUR PRODUCTS

Spur, Bevel, Spiral, Internal and Herringbone Gears — Fabroil, Rawhide and Micarta Pinions—Worms, Worm Gears and Racks—Spur and Worm Gear Speed Reducing Units—Sprockets and "Diamond" Chains.



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Manufacturers of Industrial Gears and Speed Reducing Units

PHILADELPHIA, PENNA.

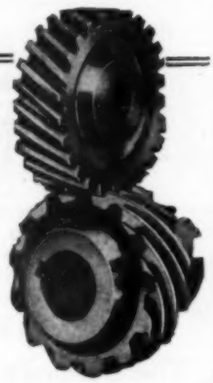
Branch Sales and Engineering Office: 12 E. 41st St., New York

Meisel (MP) Gears

for machine tools—

The unusual facilities of the Meisel Plant are especially suited to the fabrication of involved gear assemblies and units for machine tools.

Meisel gears, mounted on shafts, and in trains and nests of any type can be produced economically from your prints, or even designed by Meisel engineers. Try this service.



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Screw Machine Work — Heat Treating — Broaching — Contract Machine Work — Case Hardening — Splining — Grinding — Tooth Rounding.

Send in your prints!

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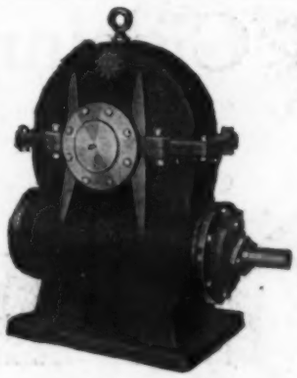

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5 STANDARD SIZES AND
60 DIFFERENT RATIOS

—1/20 to 25 H.P. giving a speed reduction from 3-3/4 to 1 to 106-1.
These units are in wide use having given years of satisfactory service on all types of work.

Fully described in our 1926 catalog—
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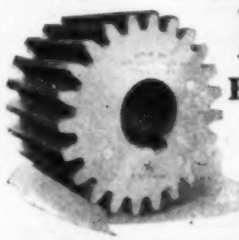
GRANT
REDUCTION UNITS

Ganschow
NOISELESS PINIONS



Fabroil - Rawhide
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Worm Gear Speed Reducers

THE HORSBURGH & SCOTT CO.
"Gear Makers Since '89" CLEVELAND, U.S.A.

"STANDARDIZATION PAYS"

A Coast to Coast Gear Service!

over 3000 sizes and styles of Standardized Gears in stock for *Immediate Delivery*

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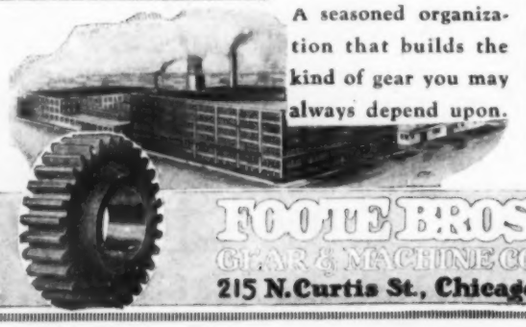
The service rendered by a Cincinnati Gear is much like the life of a great man—outstanding because of the unusual capacity for hard work.

Cincinnati Gears give outstanding satisfaction on any task. A nest of them is a trouble-free, dependable power unit. Let us prove it.

The Cincinnati Gear Co.
1825-27-29-31-33 Reading Road, Cincinnati, Ohio

30 years experience



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GEAR EXPENSE
is always low when using
SIMONDS GEARS

CAPACITY
SPUR GEARS—144 in. Diameter.
BEVEL GEARS—56 in. Pitch Dia.
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WORMS—12 in. PD., 3½ in. CP.
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Write for list of HOBS.

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"Try Simonds Service"

GEAR GENERATORS
Straight Tooth or Spiraloid Bevel Gears

Up to 32-in. O.D. cut Theoretically correct. SPECIAL facilities for CUTTING, in any MATERIAL. SPUR, MITRE, WORM, HELICAL, INTERNAL, ELLIPTICAL GEAR WHEELS, SKEW (Hypoid) BEVEL GEARS.

Let the *originators* of *Spiraloid* and *Skew (Hypoid)* GEARS with offset AXES solve your GEAR PROBLEMS

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Manufacturers of GEARS and GEAR CUTTING MACHINES

HERRINGBONE CUT GEARS
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THE EARLE GEAR AND MACHINE CO.
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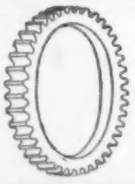

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GEARS
REDUCTION UNITS
Spur, Bevel, Worm, Spiral, Mitre
Pennsylvania Gear & Machine Co., Inc.
2239-49 E. Tioga St., Philadelphia, Pa.

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Pittsburgh

A MACHINE IS NO BETTER THAN ITS TOOLING

An Improved Lathe Center with the trouble left out—

And the following features of Nielsen improved Ball Bearing Lathe Centers tell why:

Rotates with the work and eliminates friction.
Overhang reduced to minimum.
No costly delays for regrinding point.
Wear easily taken up.
Long center spindle—no wobble.
Ball bearings take up both radial and thrust loads.
No enlarged centers.
Will not heat at highest speed.
Highest quality materials used throughout.
Tested by skilled mechanics.

Get details of this new Improved Lathe Center.

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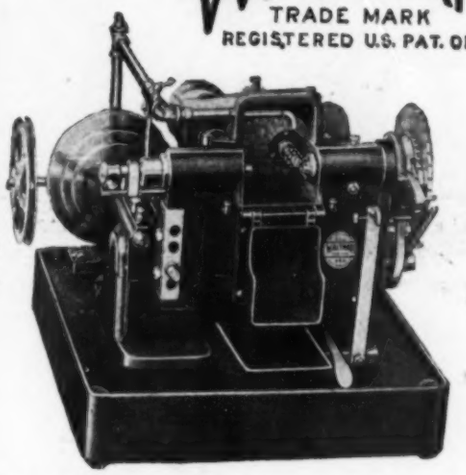

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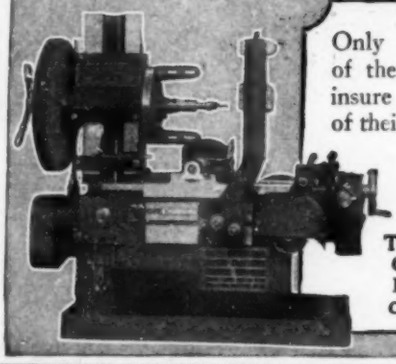
Suitable for cutting gears and pinions up to 1½ inches pitch diameter. They may be furnished with one, two or three cutters which shift automatically after each cut. At the completion of last cut the machine stops automatically.

Very fast on production. Easy adjustment makes them profitable on small jobs. No skilled operators required. *Get the Waltham Catalog*

Waltham Machine Works
High St., Waltham, Mass.

CINCINNATI GEAR CUTTERS



Only a knowledge of their details can insure appreciation of their value.

Write for Catalog.

The Cincinnati Gear Cutting Machine Co.
Cincinnati, Ohio

B & C
Hobbing Machines
Hob Sharpening Machines
BARBER-COLMAN COMPANY
Rockford, Ill., U.S.A.

ANDERSON IMPROVED
BALANCING WAY

Made in various sizes for balancing Pulleys, Gin Brushes, Turbine Rotors, Crankshafts, Polishing Wheels, Flywheels, etc.

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Henry E. Eberhardt, Pres.
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69 Prospect Street, Newark, N. J.
Manufacturers of Automatic Gear Cutting and Gear Hobbing Machinery

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Steel Bearing Balls
Burnishing Barrels
Balls—Pins—Cones
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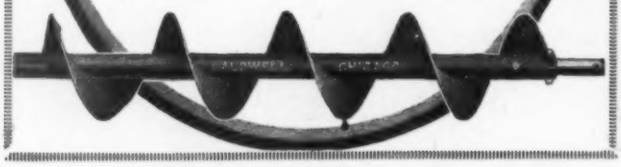

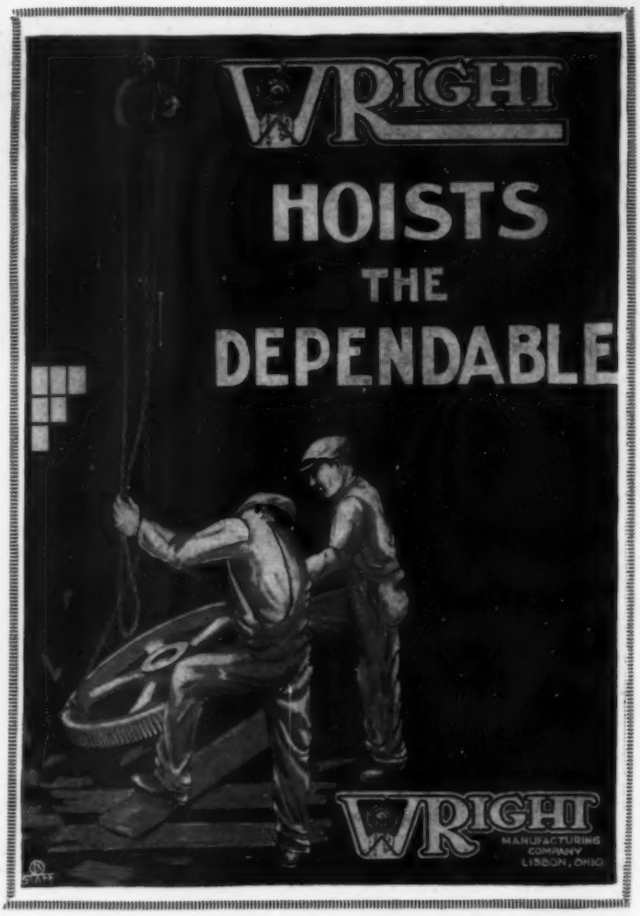

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~ The Flexible Wire Belt ~

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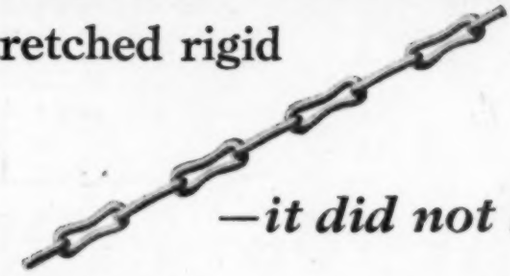
TRIBLOC CHAIN HOIST

Load chain stretched rigid



—*it did not break*

Ford Chain Hoists are made in many sizes and types. The ¼ ton to 2 ton Tribloc type is shown above. The Screw type is a light weight, powerful hoist preferred for portable use. The Differential Type is recommended for use where light loads are handled occasionally.

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Capacities up to 40,000 lbs.
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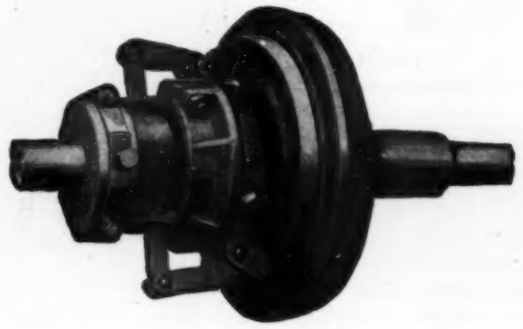

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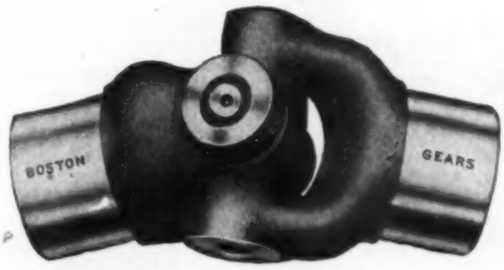

The Boston Bronze Joint was specially designed for applications where atmospheric conditions prevent the use of steel joints.

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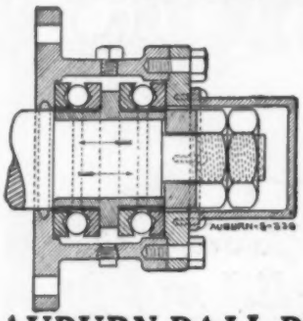

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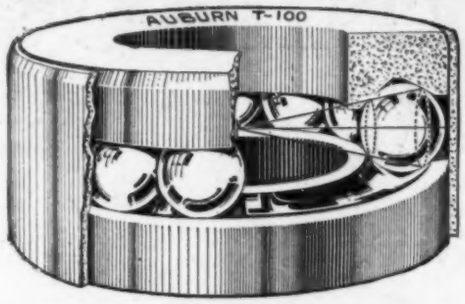

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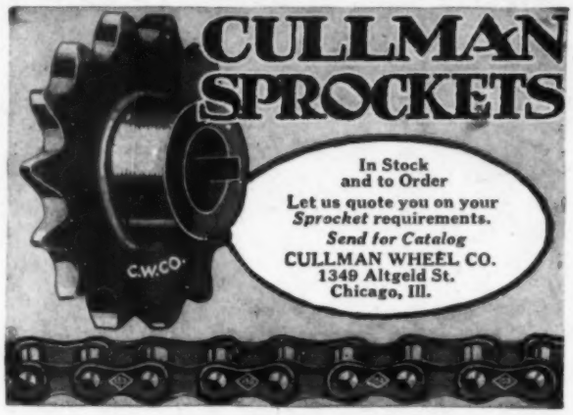

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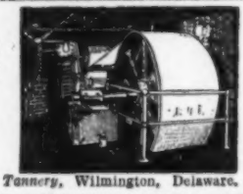

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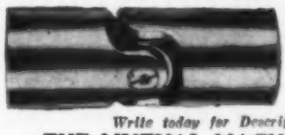

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No Sharp Corners

The Gray & Prior Universal Joint is mechanically perfect in load transmission. Friction and wear are minimized by eliminating screws and small parts and by rounding contact edges. Circular upon request.

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The "Pioneer" is the only steel hanger with the feet and legs made in one piece. There are no jointed sections to work loose or tear apart. The "Pioneer" takes most any size or type of bearing.

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The Pioneer Steel Hanger People
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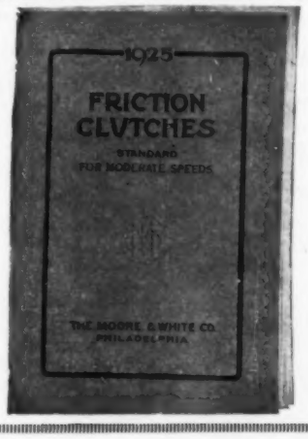

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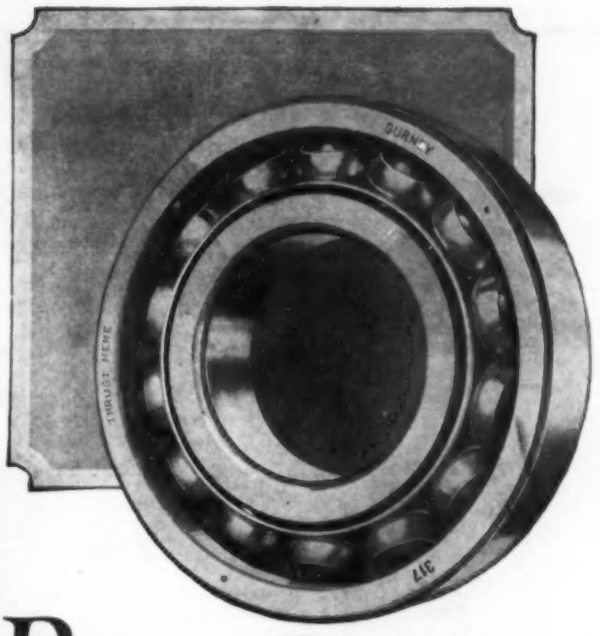

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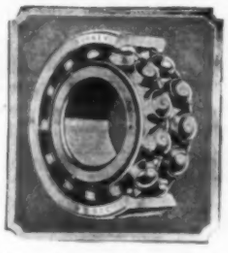

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Gurney Ball Bearing Division
JAMESTOWN, N. Y.

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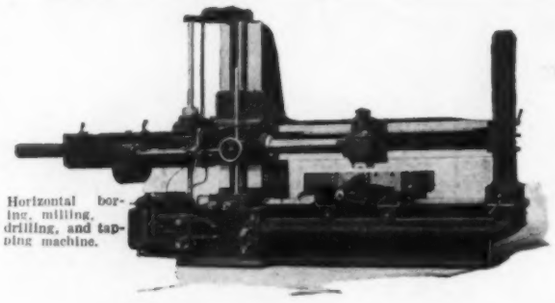

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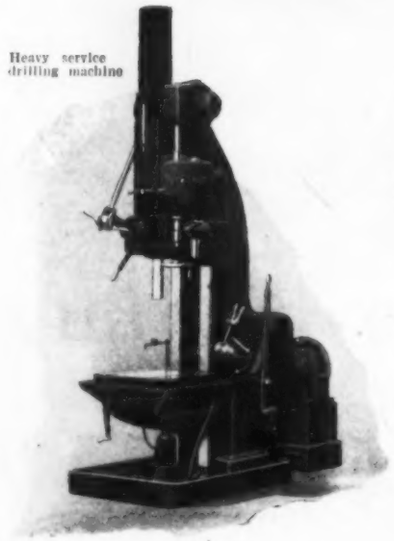
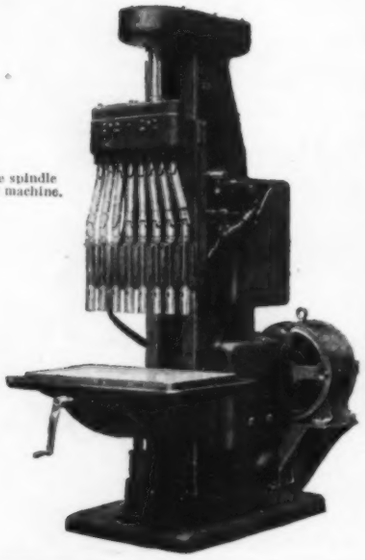


Heavy service drilling machine



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The gear box (selective automobile type) is built into the column.
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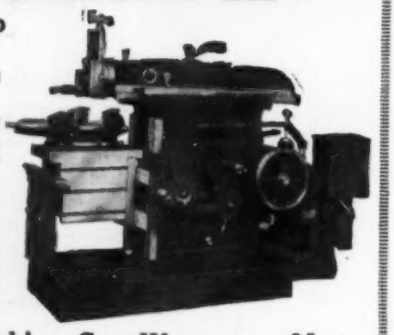

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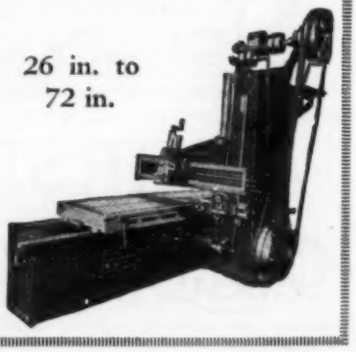

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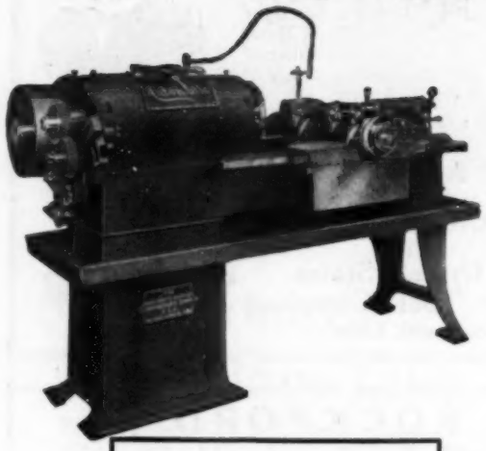

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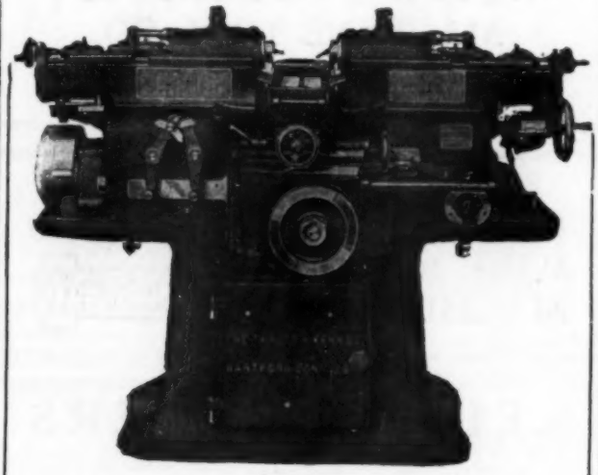

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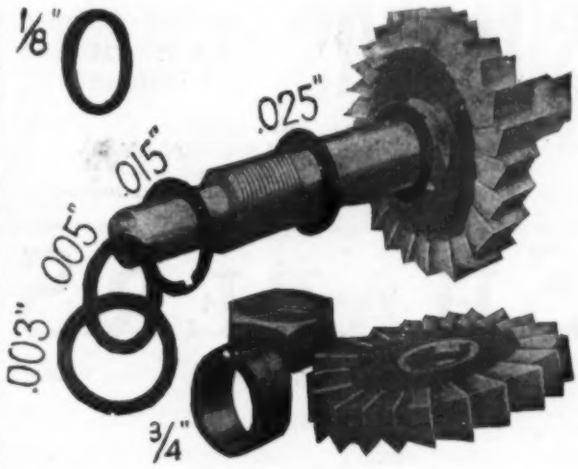

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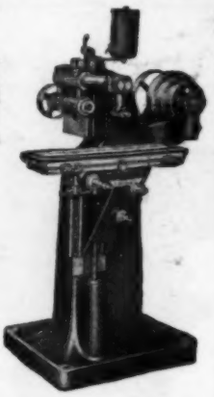

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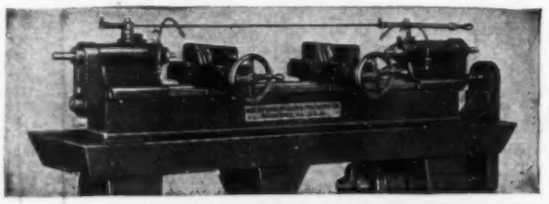

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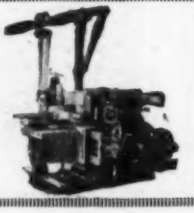
The main difference lies in the fact that the cross-rail is adjusted by two screws instead of one. Also, it can be furnished with extended crossrail and larger table, which adapts the machine to work of a larger size.

We will gladly discuss the applicability of this machine to any work you may have.



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Save Money On Jobs Like This

If you haven't enough work to justify your owning a Meyer Automatic Driller and Tapper, you can still be considerably ahead of your present drilling and tapping costs by having your work done on these quality production machines in our Contract Department.

We are equipped to drill, countersink, ream or tap any holes up to ¼ in. in dia. and 2 in. deep.

The savings our Contract Department will be able to effect will surprise you.

Send Blueprints or Samples for Estimates.

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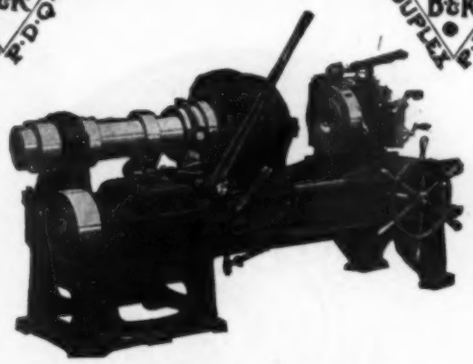

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Is the kind done by B & K Pipe Threading Machines. They work with remarkable rapidity and ease of operation. Every thread is clean and accurate. Every machine is equipped with the Peerless Die Head. Made in nine sizes, each size having a capacity of 8 to 10 sizes of pipe.

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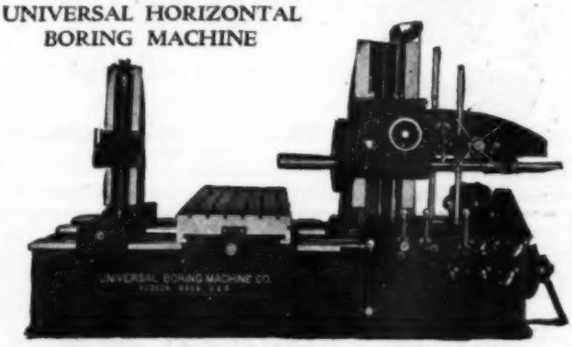

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Noble and Westbrook Engraved Roll Steel Dies and Press Stamps are made of the best quality steel by skilled workmen. You'll appreciate their artistic effect when you use them. *Get the particulars.*

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Manufacturers of Rapid Production Marking Machines, Machines for Automatic Numbering on Metal, Steel Stamps, Brass Checks, etc.
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Belt or motor driven range ⅛ in. to 18 in. inclusive, also portable machines ⅛ in. to 6 in. inclusive.

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Hand or Power Operated

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THREAD MILLER

For milling the largest threads on a production basis.

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the question of more and better grinding output is all important.

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Your grinder output has not been fully exploited until you have tested their amazing metal removing qualities.

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is a trade name for selected aluminous abrasive unequalled for cutting steel. Especially desirable in grinding Carbon and High Speed Steel Tools.

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is made from Silicon Carbide; an abrasive having such a broad application as to cut cast iron, aluminum, bronze, etc., with equal efficiency.

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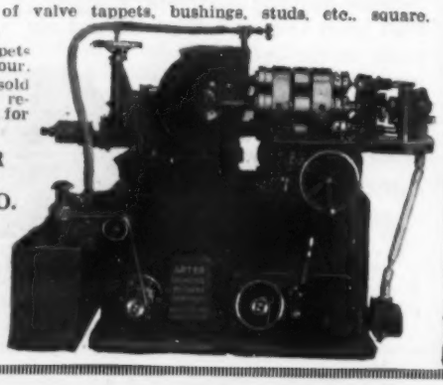
Grinds the ends of valve tappets, bushings, studs, etc., square, conical or curved.

Production on tappets 400 pieces per hour.

The first machine sold for this job soon resulted in an order for two more.



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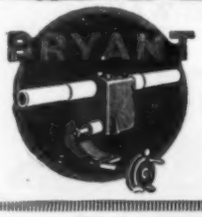

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Hole
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Manufacturers of Precision
GRINDING MACHINES
Since 1900

Surface Grinders, Tool and Cutter Grinders and New Yankee Drill Grinders

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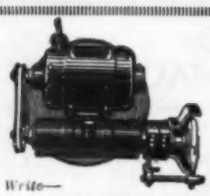

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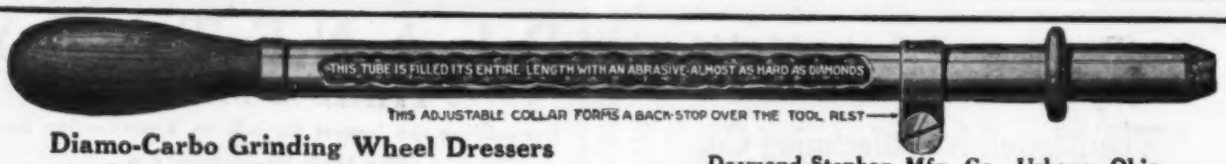
High Speed Electric Grinders

Are dynamically balanced and vibrationless
Light and portable, easily carried to any job or setup.
Operate equally well on AC or DC.
Designed for internal or external precision grinding.
Six styles and sizes provide a grinder for every need.

Write—

WISCONSIN ELECTRIC CO., 27 Sixteenth St., Racine, Wis.


THIS TUBE IS FILLED ITS ENTIRE LENGTH WITH AN ABRASIVE-ALMOST AS HARD AS DIAMONDS
THIS ADJUSTABLE COLLAR FORMS A BACK-STOP OVER THE TOOL REST

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—consist of a steel tube filled with an extremely hard abrasive. For some purposes they are as satisfactory as diamonds—at only a fraction of the cost. Try them at our expense.

Our bulletin shows our complete line. Write for a copy.

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MICRO INTERNAL GRINDER

—Now

The installation at the left, with special work mounting fixtures to grind manganese steel racks, bevelled gears, etc., is but one of many Micros which have been cutting costs for leading manufacturers by turning out more and better work.

The Micro Engineers will be glad to study your problem and submit guaranteed recommendations.

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Either Horizontal or Vertical Spindle Type

Countershaft or Motor Drive

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Plain Cylindrical, Universal and Valve Seat Grinding Machines.

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KNEE TYPE—RING WHEEL
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for all machines, 10" to 30".

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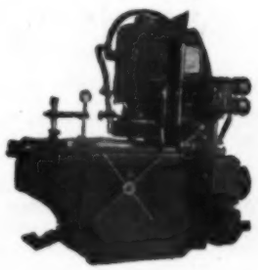
For Greater Economy Next Year



HIGH-GRADE equipment will aid you in stemming the tide of competition. By high-grade we mean tools that will do a better job in shorter time.

For flat surfacing parts there are no machines that will do better work than Blanchard Surface Grinders.

For production or for tool work, large or small pieces, quantities or small lots.

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HARRINGTON
Multiple Spindle Drills

THE HARRINGTON COMPANY
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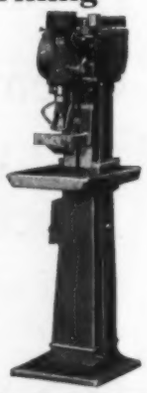
Kingsbury Vertical Drilling Machine
for profitable production

Many exclusive features are to be found on the new **Kingsbury General Purpose Type Production Drilling Machine.**

With this machine the work is clamped, drilled with pressure feed in the shortest practicable time and finally ejected. All operations being entirely automatic after operator inserts work and depresses pedal.

Let us give you all the details of this profitable single spindle unit. Send a postal for a new catalog.



Kingsbury Manufacturing Co.
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What Will It Do?

That's a question we like to answer about Self-Oiling All-Geared Drills because it makes their great drilling ability so evident.

Why not tell us about your drilling requirements and ask us what we can do to solve them with Self-Oiling All-Geared Drills.

We will be glad to help you. Catalog "A"?

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If You Use DIAMONDS Use the DYKON GAGE
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THE ROCKFORD DRILLING MACHINE Co. ROCKFORD ILL., U.S.A.

DRILLING Machines of all types—Gang Drills, Sensitive Drills, Sliding and Stationary Head Drills, Horizontal Drilling, Boring and Tapping Machines, Multi-Spindle Auxiliary Drilling Heads, etc.

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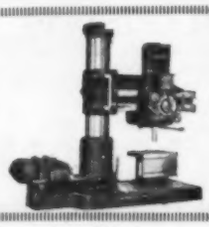


Five Years Satisfaction

The Carlton All Ball Bearing Radial Drill pleases its users. Has done so for **FIVE YEARS** and will continue to do so. Learn all its features and you'll see why.

The Carlton Machine Tool Co.
Cincinnati, Ohio, U. S. A.

"HOLE HOG"

(Photo PA-297)

with Universal Joint Features

Drills Holes Anywhere Within a Rectangle 12 inches x 8 feet

U-12 Driller with Universal Joint Heads

The above illustration shows a No. U-12 Driller with universal features for drilling tractor frames of wrought iron rectangular tubing. This is a cam feed machine with cams designed to give rapid advance to the work, proper feed through the upper wall, rapid advance through the tube to the lower wall, proper feed through the lower wall, and quick return to loading position, where the traverse is stopped, completing the cycle automatically. The machine shown can drill holes anywhere within a rectangle 12 in. x 8 ft., but larger or smaller machines can be furnished to suit the work. This feature can be adapted to either the horizontal or vertical types of machines, and is one of the latest developments in the "HOLE HOG" line of

MULTIPLE DRILLERS, BORERS, REAMERS, COUNTERBORERS, LAPPERS, TAPPERS AND DUPLEXES

Designed and Built by the

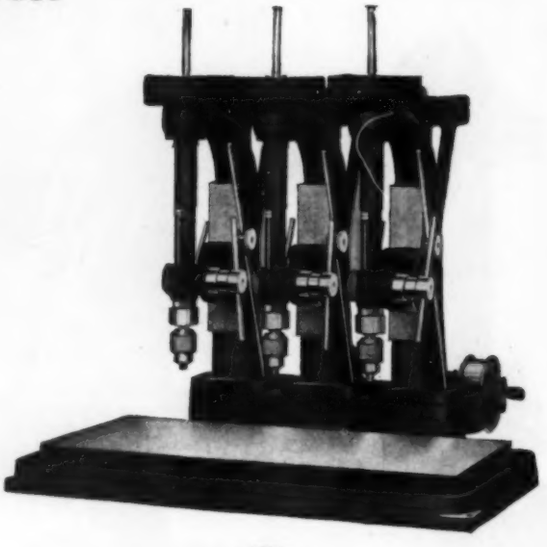
MOLINE TOOL CO., Moline, Ohio

The LELAND-GIFFORD
High-Speed Sensitive Drill Press

Runs as smooth as a gyroscope at 10,000 R.P.M.

Speeding 10,000 r.p.m., the spindle of a Leland-Gifford appears stationary, like the wheel of a fine gyroscope. There's no blur at the edges to tell of motion—nothing but the "cry" of the drill as it bites its way through the tough metal. That's because Leland-Gifford Drill Presses were designed and built expressly for high-speed service—3,000 to 10,000 r.p.m. is their *normal* speed. Every moving part is tested to the greatest possible perfection of running balance; all bearings and spindles are of ample size to retain their accuracy year in and year out.

You want the "last ounce," L.-G. will see you get it.



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What Is a Requisite of the Champion?

Endurance which is the product of long training in a specialty.

Since 1884 our entire manufacturing efforts have been concentrated on the development and improvement of our hack saw blades.

hard teeth
soft back

The Flexible Hack Saw for all around use.

Made of TUNGSTEN STEEL

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Watson-Stillman valves are designed to perform their functions with ease and safety. The materials are the best obtainable, and each valve or fitting is tested to a safe overload.

Our line embraces an almost endless number of combinations designed to meet the varied requirements of hydraulic systems.

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MODEL B GEAR COUNTER
will give you your accurate production. Tested 20,000 per hour.

Model B (Five wheels)
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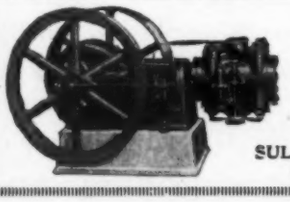
R. E. HART MFG. CO., MERRILL PARK BATTLE CREEK, MICH.



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Cheap air power for the shop is supplied by "WG-6" Wafer Valves—Controlled automatic lubrication—Inlet valve unloading system.

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ETNA Swaging Machines

will handle the most difficult work, built to take from ¼ in. up to 4½ in. capacity.

Tube Making Machinery
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Vertical Boring and Drilling Machines
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TAPPING MACHINE

Proven time- and money-saver in tapping small sheet-metal parts, hard and slow to jig.

The machine runs at three spindle speeds: 1350, 1950 and 2550 revolutions per minute, with an index respectively of 45, 65 and 85 holes per minute, or a maximum of 5100 tapped holes per hour.

These speeds can be varied, and in brass the only limit is the speed with which the operator can feed the parts into the dial.

Collets are furnished to hold taps from 0 to ¼ in. diameter. Machine is designed either as bench or floor machine, and furnished with either motor or countershaft drive.

We'll be glad to give complete data when quoting prices.

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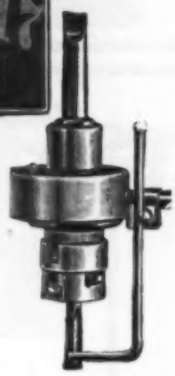
Errington Auto Reverse Friction Tapper

Cylinder Style C. Tapping Blind Air-Holes in Cooled Automobile

(AMERICAN MACHINIST, Mar. 14, 1907)



The breakage of a single tap on this job would cause an intolerable blemish in the appearance of the piece and result in heavy loss in time and money. The Errington Sensitive Adjustment and Quick Reverse insure perfect results. Regulate the power of the machine to just drive and remove all danger of breaking the tool or injuring the work. Fool proof, fits any drill press, and taps steel as safely as cast iron. Seven sizes, ⅛ in. to 2 in.

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Dreses Simplex Radial Drills
2½ x 3 Ft.

A Drill That Invites Comparison with Any of Its Type.

The Dreses Machine Tool Co., Cincinnati, Ohio

Rapid Fire Production—

U. S. Multiple Drill Heads

—convert any single spindle drill into a two or more holes at a time machine. Drilling a score of holes in the same time as it used to take to drill one represents a distinct saving in production costs.

Send your layouts to Our Drill Head Specialists.

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***Speed up with* HOEFER Drilling Machines**

Their "minute-saving" features of design will greatly increase your drilling output and profits. Get the complete details from our branches in the principal cities.

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Standardize on **FOOTBURT** *Drilling, Boring Tapping Machines*
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Leading manufacturers of Single and Multiple Spindle Drilling Machines, Cylinder Boring Machines, etc., and various types of special equipment.

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Pioneers in Better Drilling Methods

Fox Multiple Drilling and Automatic Tapping Machines

Also Fox "Superflex" Power Presses

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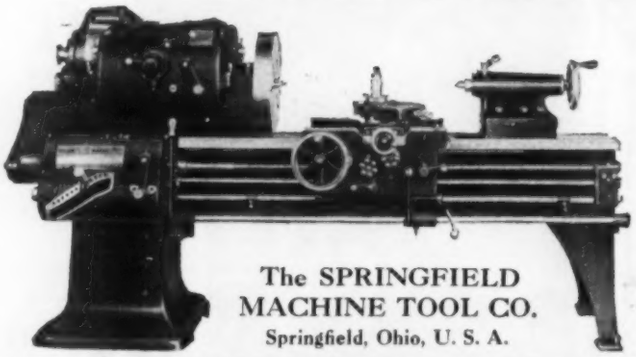
SPRINGFIELD Ball Bearing Geared Head Lathe

Worthy of its Name



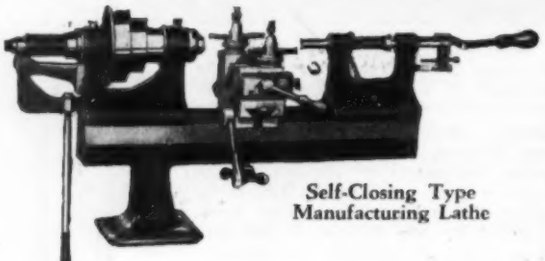
The SPRINGFIELD MACHINE TOOL CO.
Springfield, Ohio, U. S. A.

These new models represent the embodiment of 38 years of successful experience.

Springfield Lathes are built under the standards established by a manufacturer of *fine machine tools.*

For all the details just ask for Circular No. 150.

The Springfield Machine Tool Co. Springfield, Ohio, U.S.A.



Self-Closing Type Manufacturing Lathe

An exceptionally fast bench tool

This is the Standard S. & C. Bench Lathe, arranged for spring operation of the collet. A foot treadle opens the collet and a spring closes it. This feature leaves both hands free for tooling and tail-stock operation and means just that much time saved.

Ideal for light manufacturing and all tool room work. Compact and readily portable.

SLOAN & CHACE, Inc.
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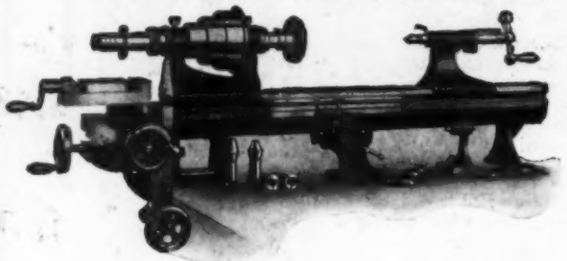
STARK PRECISION BENCH LATHES

Six Sizes. From ¼-in. to 1¼-in. Collet Capacity.



For light tool, instrument and production work. Easily adapted for high production by special tooling.

STARK TOOL COMPANY Waltham, Mass.
Established 1862. *Originators of the American Bench Lathe.*

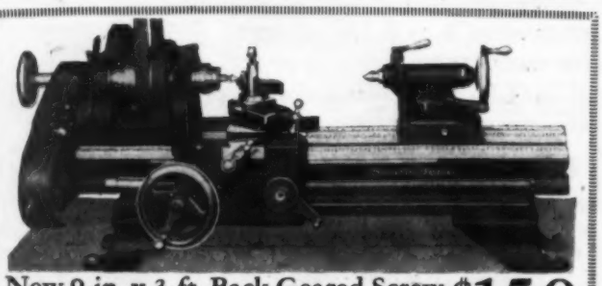
The Hjorth Lathe is busy all day—

This precision bench lathe handles light and medium jobs of turning, drilling, screw cutting, milling, etc. It's a versatile unit that will cut production costs because it is never idle.

Send for further information

HJORTH LATHE & TOOL CO.

Manufacturers of the Hjorth Bench Lathes and Attachments, Submerged Drilling Attachments, Internal Grinding Attachment, Marking Machines, Spring Winders, Reamers, Etc. Office: 24 School Street, Boston, Mass.
Works: Woburn, Mass.



New 9-in. x 3-ft. Back Geared Screw Cutting Manufacturing Bench Lathe $150

Complete with Countershaft and Equipment

Has ¾-inch Hollow Spindle, 18 inches between Centers, on 3-foot Bed; 3½- and 4-foot Beds also available. Power required ¼ H.P. Many attachments can be fitted to Lathe. Write for Bulletin No. 22-J. Easy Payments if desired.

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STEINLE TURRET LATHES

A modern high power, high duty production turret Lathe for bar or chucking work. Designed and built sufficiently powerful and rigid to enable use of greatest number of multiple cutters and thus insure rapid, accurate and economical work. Why not write us for full particulars.

STEINLE TURRET MACHINE CO.
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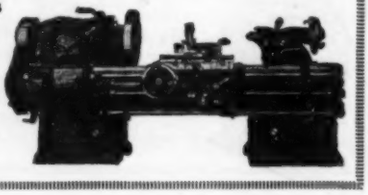
G-K Heavy Duty Lathes

—have proved their ability to turn out both quality and quantity production. Ask men who use them.

Send for a G-K Catalog.

The Greaves-Klusman Tool Company
Cincinnati, Ohio



Rivett JUNIOR BENCH LATHE No. 507

Versatile—Accurate—Powerful—Economical

The Rivett Junior Bench Lathe in the hands of the mechanic works equally as well as in the hands of the trained scientist who deals with accuracy to the extreme. Its ruggedness survives the inevitable abuse. In fact this bench tool's scope of usefulness has no boundaries. Its cost is within reach of all due to the fact that non-working parts are not machined finished and to other economics in the manufacturing process which do not reduce efficiency.

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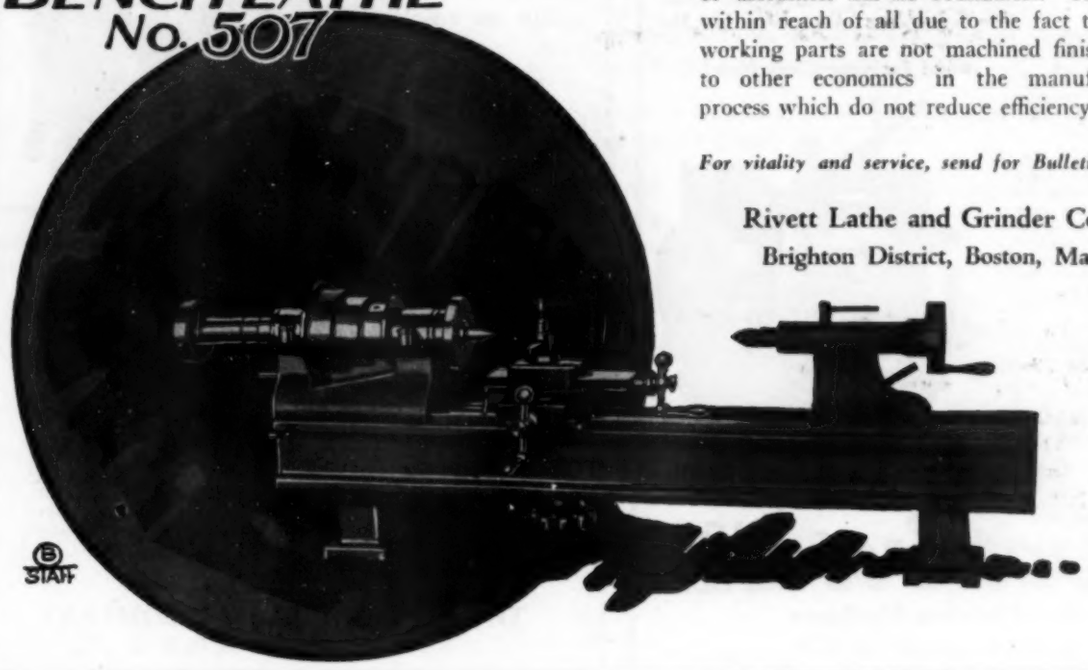
Rivett Lathe and Grinder Corp.
Brighton District, Boston, Mass.



The same everywhere

Here, there, in practically every section of the country you will find Cataract Quick Change Swing Precision Lathes meeting satisfactorily a wide variety of requirements.

There is plenty of evidence to substantiate our claim that Cataracts are money-making high precision lathes. Ask us for some of this evidence.

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"Small Lathes for Big Jobs"

Dalton Seven Inch Engine Lathes are made with 30 inch and 36 inch length of bed in bench type or for floor mounting as shown. A complete line of attachments is available for use with these lathes.

Plain Floor Leg Mounting

Send for Bulletin 700

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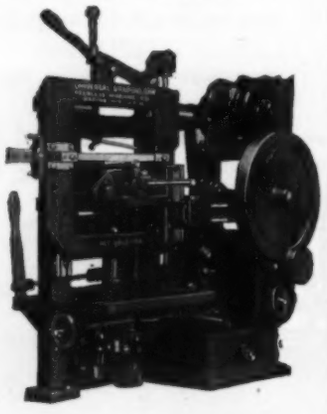

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Modern Equipment Cuts Costs

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SAVES TIME—LABOR—BLADES

It feeds the bar. Cuts duplicate pieces all automatic at small cost.

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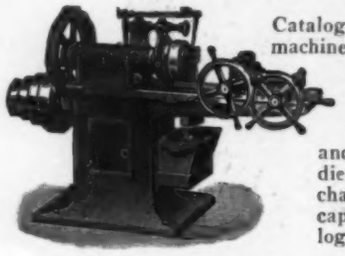

Catalog M will describe the machine in detail. Dies can be changed in less than a minute. Acme Die heads are lined with hardened tool steel and ground to size. The dies are made interchangeable with the steel caps. Write for Catalog M.

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Sizes 14 to 42 inch

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Manufacturers of Grinders, Buffers, Speed Lathes and Manual Training Lathes.
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Full Swing Side Carriage, Heavy Duty Type Machines, covering Bar Work from 2 in. to 12 in. and Chucking Work up to 26 in. in diameter. Dealers in all principal cities.

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Compact, motor-driven machines that are adapted for any place in the shop.

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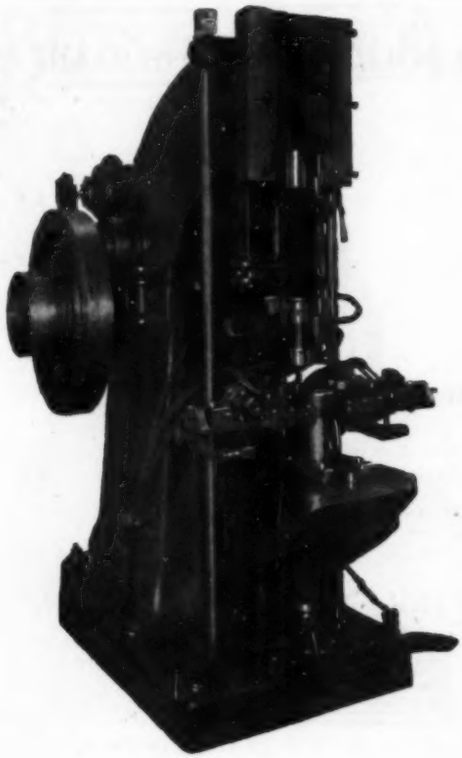

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A hot headed bolt has many advantages, particularly when electrically heated and instantly forged.

You can get a Kobert Electric Forging Machine which will make this kind of a bolt, pin or screw.

It will handle stock of from ¼ to ¾ diameter, and from 1½-in. to 16-in. long.

The fixture is hand operated, and may be changed for various sizes quickly, enabling the filling of short orders promptly, and allowing the carrying of a minimum stock of parts not in large demand.

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has paid for itself many times over on such work in scores of shops.
It is easily handled and possesses the "fool proof" features that keep it long in service. Tell us something about your work.
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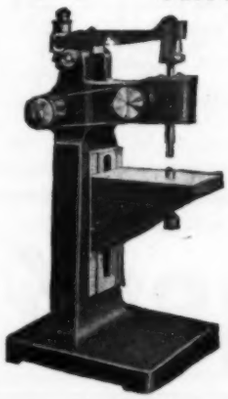

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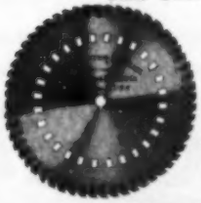

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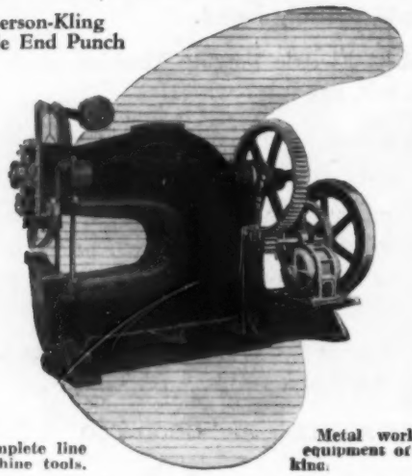

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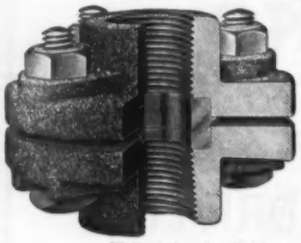

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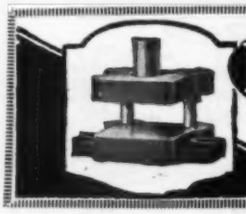

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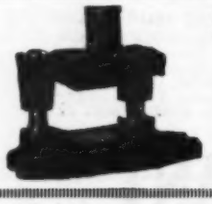

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Presses, Punches, Squaring Shears, Rotary Shears for production; also the smaller machines and tools for the sheet metal shop. Write for information.

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Bliss economy means not only low maintenance cost, but also low operating cost and speedy production. Ask us to tell you more about the Bliss Press.

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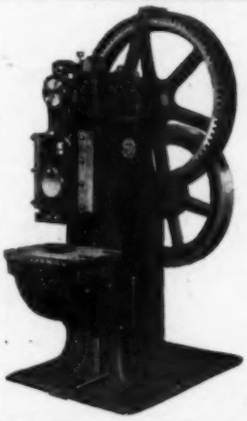

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Universal
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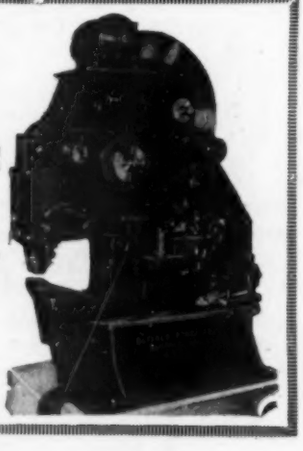
Bar Cutter, Punch and Shears combined; frame unbreakable.



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DOUBLE CRANK PRESSES

"Toledo" Double Crank Press, Series No. 90

THE "TOLEDO" Double Crank Presses are for cutting out and forming large articles in tin, brass, copper, sheet steel, cardboard, paper cloth, etc. Among these may be mentioned automobile parts: such as bodies, fenders, running boards, rear axle housings, chassis rails, etc. They can also be used to good advantage for multiple gang punching or perforating, and for operating several different kinds of dies, where special work requires a series of operations one after the other, or for operating duplicate dies in gangs. When fitted with shearing blades they can be used for squaring shears for special work.

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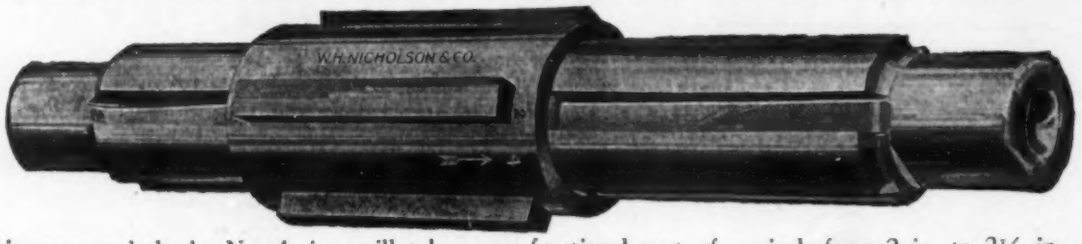

This one mandrel, the No. 4 size, will take every fractional part of an inch from 2 in. to 2½ in. It would require 32 solid mandrels to do this in 64th sizes, and intermediate sizes could not be taken. Better order a few "Nicholsons."

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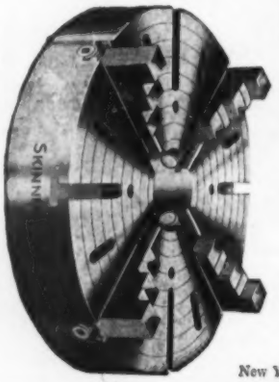

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The Walker SINGLE-STROKE Rotary Surface Grinder

increases production and eliminates spoiled work through its simple semi-automatic operation whereby all controls are operated through one lever. Equally at home on Toolroom or Production work.

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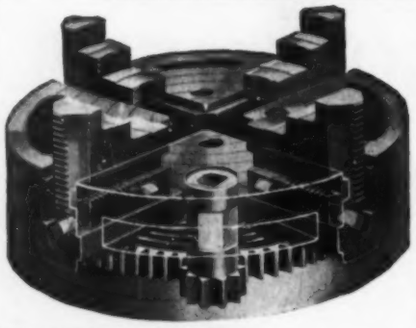

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Increased Production in one shop

20%

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Equals TWO but costs little more than ONE

That's the whole story of the **Lapointe DUPLEX Broaching Machine** in a nutshell.

The tandem draw-bars give double the output. It requires but one operator, half the floor space and can be independently adjusted to broach two different runs of parts at once. *Write for the Catalog.*

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Our policy is to equip the machine in every detail with work holding and feeding devices that will enable them to give the most efficient service with unskilled help at a low upkeep cost.

Machines built to date have capacity ranging from a pin point to 2½ in. diameter on solid stock and to 6 in. on tubing.

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Oldest Tap and Die Makers in America
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"CUSHMAN" CHUCKS 1862

4 Jaw Independent Type "The Incomparable" also 3 & 4 Jaw Self-Centering Chucks, 2 Jaw Lathe Chucks, Face Plate Jaws, "The Hartford" Drill Chucks

OUR LATEST! THE NEW TRI-PLEX CHUCK Self-Centering, Independent, Eccentric

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These chucks are made with either iron or steel bodies and in three or four jaw types. The jaws are reversible and operate universally or independently.

LATHE AND DRILL CHUCKS

Price and dimension list on request

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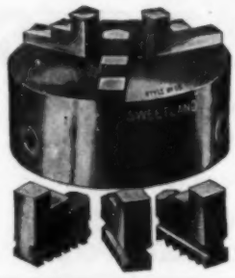
Established 1856
NEW LONDON CONN.

SWEETLAND CHUCKS



The "Old Hand's" choice

Because he knows what it means to have a reliable chuck; a chuck that will retain its accuracy and grip year in and year out; a chuck that needs no "fussing," simple and positive in operation. Because he's probably used Sweetland Chucks as long as he can remember.

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Increase Lathe Output With McCrosky Turrets

They enable the operator to perform 3 to 6 operations with one set-up, without stopping his machine to change tools. Made in nine styles and many sizes.

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BARKER Wrenchless Chucks

Are great time savers for all classes of turret lathe, screw machine, automatic and semi-automatic work. Durable in construction.

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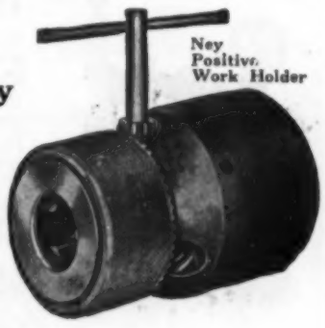
No drawback rods to reduce spindle capacity



Ney Positive Work Holder

There are no drawback rods in the makeup of the Ney Positive Grip Work Holder to reduce the capacity of the spindle for bar work. As an economical machining unit it has no peer—its six collets do the work of eighteen ordinary ones. Irregular bar stock—round or hex—is gripped without adjustment. Write for our Illustrated Folder, describing its other good points.

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Tycos
temperature instruments

do not show you the "color" of parts being treated—they tell you in fractions of degrees the temperature of the furnace. They rarely go wrong, consequently your tools are always right.

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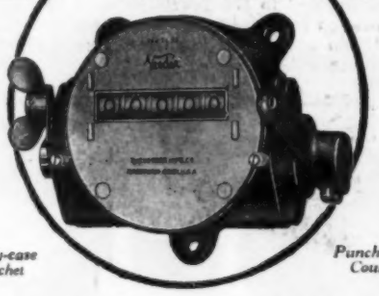

Heavy-case Ratchet *Punch Press Counter*

Call for *records* from your machines, so every minute of their working time must *count* in recorded production. Look for improvements in operating methods—for *harder work*—as they register in the output. Look for these things on Veeder Counters, and your workmen will see that you *get* them! Write for booklet.

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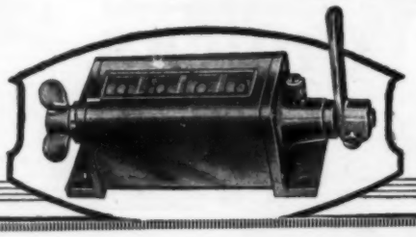

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Here it's working on a Miller but that doesn't half tell the story.

With it you can DRILL holes in odd pieces, MILL compound angles; GRIND angular surface; PLANE complicated parts; comes in mighty handy on the Shaper, too.

It takes only a few seconds to get the right set-up with the Universal. It eliminates the bother and uncertainty of jacks, wedges and other makeshift set-ups.

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AMES Micrometer Dial GAUGES

A Model for Every Purpose

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International Standard Scleroscope (Hardness Tester)

The Scleroscope

is now used in hundreds of plants for its accuracy in hardness testing. It is direct reading and can readily be operated by anyone. Ranges from softest metals to hardest steels without adjustment. It is invaluable in ordering materials to specifications. The free booklet will interest you.

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Our Bulletin tells the whole story.

Oliver Instrument Co., Adrian, Michigan.

FOR ACCURATE PRODUCTION RECORDS The Productimeter

Get the right count with the Productimeter, on punch presses, screw machines, drill presses, shears,—any type of production unit. We specialize in "counting" problems and assist you to make the proper application. Write for and keep the Productimeter Catalog on file.

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ONLY THE BEST ARE GOOD ENOUGH

MAKING 2400 different sizes, shapes and cuts is our idea of giving service to the trade; just as important as putting the best material and workmanship into their making.

And the fact that they *last 25% to 35% longer* means that you effect a worthwhile saving on your File costs.

American Swiss
File & Tool Company
410-416 Trumbull Street
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American Swiss Files
"files of precision"

FEDERAL

PRECISION
DIAL-INDICATORS
for every conceivable measurement
Send for Bulletin.
FEDERAL PRODUCTS CORP.
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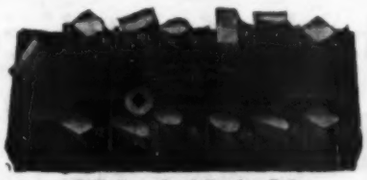
All sizes—
all styles in stock
RIVETT LATHE & GRINDER CORP.
Brighton District of Boston, Mass.
The old masters of the art of toolmaking

DAVIS KEYSEATER
This low cost machine will handle any keyseating job in the shop up to 1 in.
Write for illustrated bulletin.
DAVIS KEYSEATER CO., 255 Mill St., Rochester, N. Y.

O K Tools for Lathes Planers Shapers Boring Mills



Milling Cutters Inserted Tooth Type

O K Standard Lathe Set

4 Reasons— OK Tools

1. Provide a tool steel economy of upwards of 50%.
2. Save time on long runs by furnishing a supply of *interchangeable* tools.
3. Increase production by keeping machine operators at their machines.
4. Save time on every tool change because the tools are changed without disturbing the holder.

Your inquiry entails no obligation. *Write.*

THE TRADE O K MARK TOOL CO., INC.
SHELTON, CONN.

SET and CAP SCREWS
That You Can Use and Use and Use!

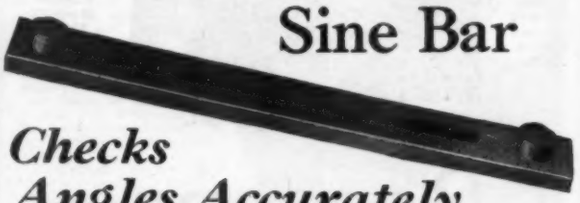
THIS "MAC-IT" is the most complete line of heat treated machine screw parts manufactured in the United States or elsewhere

Built to serve under hard conditions, to eliminate tie-ups, to prevent accidents and to increase production. For Service—Safety—Satisfaction.

Ask your dealer for MAC-IT Screws, or write

THE STRONG, CARLISLE & HAMMOND CO.
General Distributors
1392-1394 West Third St., Cleveland, Ohio

The Taft-Peirce Sine Bar



Checks Angles Accurately

The T-P Sine Bar is the solution of angle measuring problems. It affords a simple, rapid method of angle measurements for everyday shop practice. A complete table of constants, included in Bulletin No. 1101—insures the highest degree of mathematical precision—without calculations.

THE TAFT-PEIRCE MFG. COMPANY
WOONSOCKET RHODE ISLAND, U.S.A.

Manufacturers of Thread Milling Machines, Production and Inspection, Tools, Gages, Magnetic Chucks, Etc., and Makers of Special Tools and Machines on Contract.

Unretouched portrait of Threadwell Taps

REALIZING that "small tools" represent an important investment in most shops, we urge you to "Make a Test with Threadwells"—first.

Learn to know the satisfaction of depending upon Threadwells and the unlimited "know how" service back of them.

Let this service help you get the correct tap for your work—standard if possible, special if necessary.

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GREENFIELD, MASS.

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Cleveland, O.
New York, N.Y.
Indianapolis, Ind.
Chicago, Ill.

San Francisco, Cal.
Rochester, N. Y.
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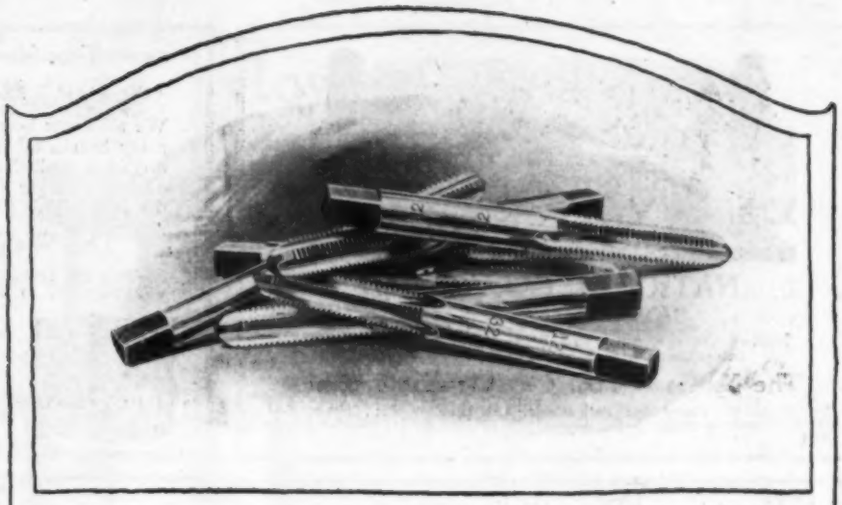
Machine Screw Taps

Dies
Reamers
End Mills



It must be one thing or the other

WHERE holes are tapped for machine screws they are bound to be either right or wrong.

In either case the result is due to the taps.

Buying standard machine screws and then using taps that are ordered by size and not by *name* means trouble.

The taps you use today may be slightly oversize—a loose fit.

Tomorrow another tap may not measure up to standards—a stripped thread.

Brubaker Machine Screw Taps run true to size—today, tomorrow, every day you buy them.

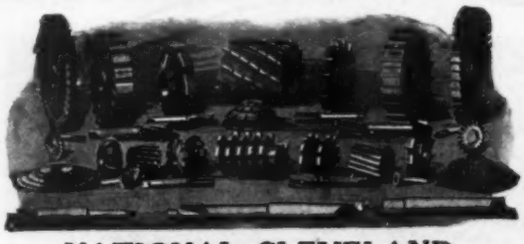
They may be speeded up without danger of breaking in the hole.

Made in taper, plug and bottoming types.

Try a few—note their difference.

W. L. BRUBAKER & BROS. CO.

Factory, MILLERSBURG, PA.
Sales Office: 50 Church St., New York



NATIONAL CLEVELAND
"Extra Service" Tools

Milling Cutters, Spur and Worm Gear Hobs, Reamers, Interchangeable Counterbores, Special Tools.

The National Tool Co., Cleveland, Ohio

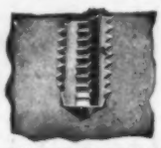
New York, 41 Murray St.; Philadelphia, 816 Chestnut St.; Chicago, 634 Madison Terminal Bldg., 9 So. Clinton St.; Detroit, 3—116 General Motors Bldg.

Trouble Caused by Broken Taps Has Been Overcome

We all know how irritating and time wasting it is when a tap breaks off in a hole. In the majority of cases the thread is spoiled in the usual attempts at removal. This means a larger hole, new threads or the scrapping of the job.

The Walton Broken Tap Extractor

removes the broken tap, at or below the surface, quickly and without injury to the thread.



Write for Descriptive Bulletin giving details and prices of the tool that usually pays for itself on the first job.

THE WALTON COMPANY
311 Pearl St., Hartford, Conn., U. S. A.

Adjustment Simplicity

To change the diameter of the PAROB Reamer, you merely use a screw driver. There are no nuts nor exposed screws to become lost nor damaged and nothing can slip when once adjusted.

PAROB
(Parallel Oblique)
Expansion Hand Reamers

are unique, but mechanically correct in design. Each straight blade is preceded and followed by an angular blade. This prevents chatter and thus insures a smooth finished hole. Get the details.

The Gammons-Holman Co.
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A mechanically-perfect precision head of simple design and few parts.

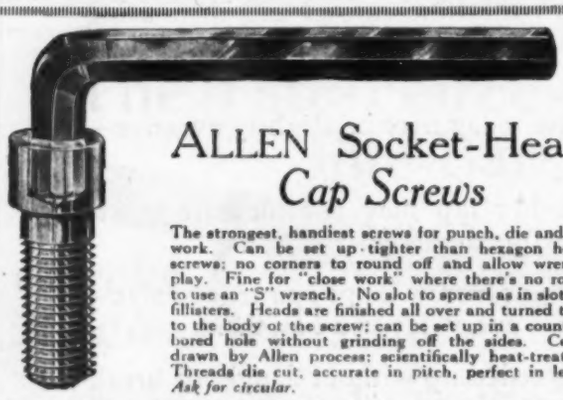
All parts of heat-treated nickel steel.

This compact head has the least overhang of any Head on the market, yielding utmost rigidity and maximum table travel.

Made in a full range of sizes to fit all standard spindles and arbors.

Send for descriptive bulletin and price list.

J. M. Waterston, 426 Woodward Ave., Detroit, Mich.



ALLEN Socket-Head *Cap Screws*

The strongest, handiest screws for punch, die and jig work. Can be set up tighter than hexagon head screws; no corners to round off and allow wrench play. Fine for "close work" where there's no room to use an "S" wrench. No slot to spread as in slotted filliisters. Heads are finished all over and turned true to the body of the screw; can be set up in a counterbored hole without grinding off the sides. Cold-drawn by Allen process; scientifically heat-treated. Threads die cut, accurate in pitch, perfect in lead. *Ask for circular.*

THE ALLEN MFG. CO. 129 SHELDON ST. HARTFORD, CONN.

—Standardize your threads—
by using one make of threading tools

MURCHEY

Self-Opening Dies and Collapsible Taps
101 Varieties—All Adjustable—Write for Catalog

MURCHEY MACHINE & TOOL CO.
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Features—unique socket—extra small sizes—long life—holds tightest set but is easily removed. Send for test samples and folder B-814.

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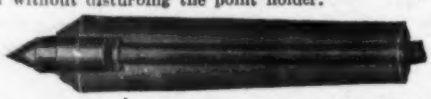
ECONOMY CENTER POINTS

The removable points may be changed without the aid of special tools and without disturbing the point holder.



Atwood Manufacturing Equipment Co., Anderson, Ind., U. S. A.

BUCKEYE

Twist Drills, Reamers and Special Tools

THE BUCKEYE TWIST DRILL CO., ALLIANCE, O.

Chicago Office, 542 West Washington Blvd.

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A rugged, low-cost, heavy-duty steel chair—correctly designed for comfort and durability—angle iron frame construction—Bessemer rungs—a comfortable wood seat—a snug back—a foot rest—no frills—no fancy work—just fifteen pounds of real chair built for lasting service—THAT IS THE MEECO 504A CHAIR.

Fig. 504A

There are 5 other types of MEECO All-Steel Chairs and Stools specially designed for hard service at machine or bench. Furnished with three or four legs, 12 in. or 14 in. seats, with or without backs, in heights of 18 in., 20 in., 22 in., 24 in., 26 in., 28 in., 30 in. or adjustable.

MEECO CHAIRS are priced for economy. It will pay you to investigate. Write today!

MFG. EQUIPMENT & ENG. CO.

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FOUNTAINS—LOCKERS—SHELVING—WASH BOWLS

High Speed Drills

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STEEL TYPE OUTFIT $35.00

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Twist Drills, Reamers

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Screw Extractors

The CLEVELAND TWIST DRILL COMPANY CLEVELAND

THE SOMMER & ADAMS CO.

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How to handle yourself in business

—the facts about getting along with superiors, associates and subordinates

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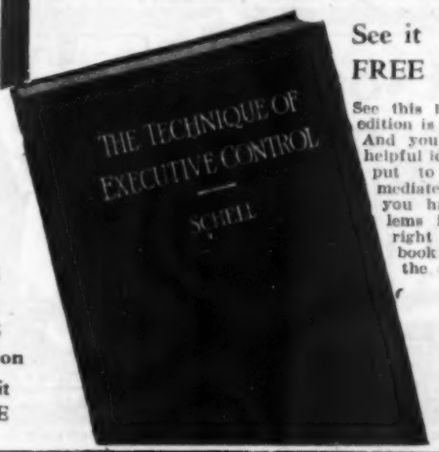

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For Every Lubricating Requirement

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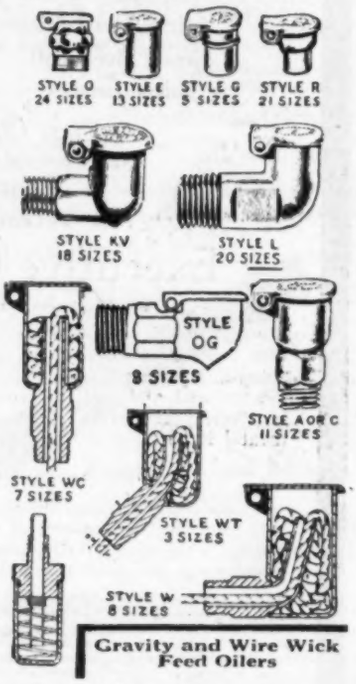

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Oil grooves are more than an afterthought

They are essential to the efficient working of the machine whose bearings they serve. That is why hammer and chisel methods of grooving have gone out of fashion and it is also the reason why under present manufacturing conditions, the use of a specialized machine is necessary to the economic performance of this work.

The Fischer Oil Groover is made in two sizes with a capacity up to 5-in. x 8-in., and 15-in. x 15-in. bearings, respectively. It will quickly cut oil grooves in or around straight or taper parts within its range, with absolute precision.

Get the full details.

No. 1 Machine

The Fischer Oil Groover

Fischer Machine Co.

310-316 N. 11th St., Philadelphia, Pa.

Chas. A. Strelinger Co., Detroit, Mich.; Motch & Merryweather Mach. Co., Cleveland, Ohio; Motch & Merryweather Mach. Co., Pittsburgh, Pa.; Henry Prentiss & Co., Rochester, N. Y.; Coates Machine Tool Company, London; Yamatake Company, Japan; Coe & Clerici, Milan, Italy; Aux Forges de Vulcain, Paris, France.

Like the juice from an Orange

When a Curtis Centrifugal Oil Extractor electrically-driven and self-contained, finishes with a load of chips all the oil that can be extracted has been extracted. Consider the saving in cash and *write today for a copy of the descriptive circular.* The motor is mounted on the spindle under the pan.

The Leon J. Barrett Co.

Successor to

The Curtis Machine Co.
Worcester, Mass.

GREAS-OM-ETER

—insures constant, uniform and economical lubrication.

Write today for full data

Greas-om-eter Corp., 460 Montgomery St., San Francisco

Use ARMSTRONG Tool Holders

Save
All Forging
70% Grinding
90% Tool Steel

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
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TUCKER OIL HOLE COVERS

Made in a variety of styles and many sizes to suit all needs. Send for descriptive catalog and price list.

W. W. & C. F. Tucker, Inc.
Hartford, Conn.

DEMCO SAFETY Cleaning Machine

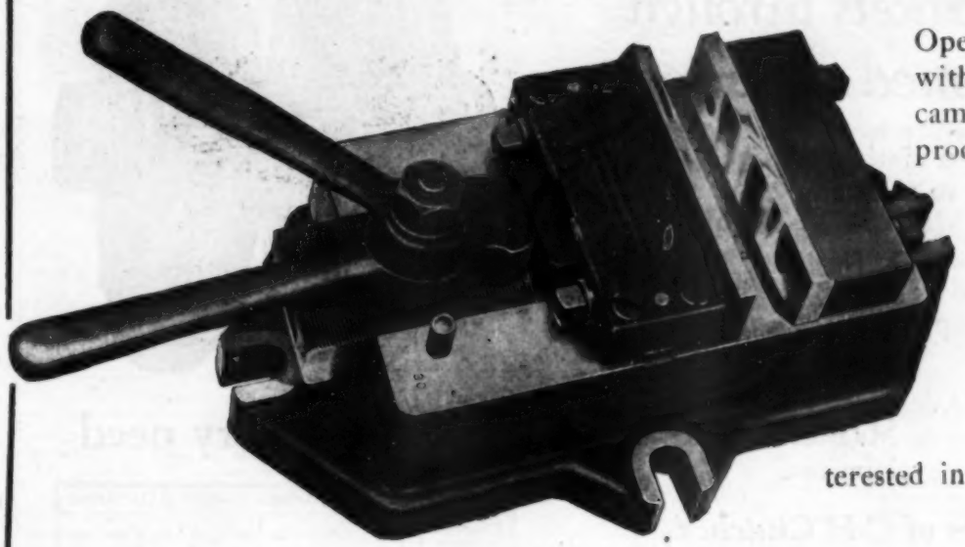
for cleaning small parts

Refer to Nov. 4th and 18th issues for additional information

DEMCO, INC.
105-115 South Calvert St., Baltimore, Md.

Here is a Vise that:

grabs a job like a Terrier; hangs on like a Bulldog; and lets go with the speed of a Hangman's Trap



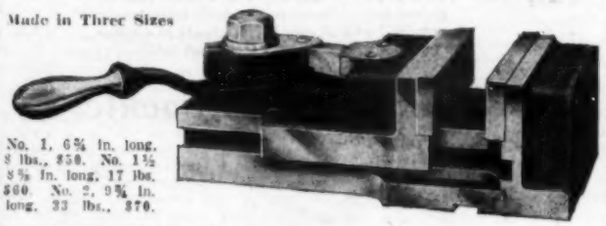
Operate both levers with one hand. The cam faced lower lever produces the speed. The upper lever contributes the powerful grip. Time is saved on every job—manufacturing cost is reduced. You will be interested in our catalog.

The Hartford Special Machinery Co., 280 Homestead Ave., Hartford, Conn.

The Pronto Quick Operating and Wide Opening Lever Vises

Designed for Milling and Drilling Machines and is especially adapted for any work where a large number of pieces are to be quickly handled.

Made in Three Sizes



No. 1, 6¾ in. long, 8 lbs., $50. No. 1½ 8⅝ in. long, 17 lbs. $60. No. 2, 9¾ in. long, 33 lbs., $70.

Prices subject to discount of 15 per cent.

Manufactured by

EDW. PURVIS & SON

110 York Street, formerly manufactured by Carter & Hakes Brooklyn, N. Y.

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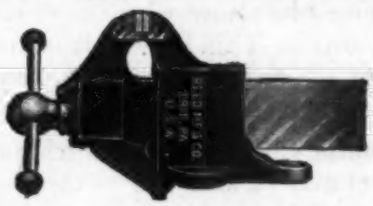
Cost less in the end.



No "upkeep" necessary

The design is correct for most strength and most rigidity. Send for *booklet*.

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THE CARROLL-JAMIESON MACHINE TOOL CO.
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Simple sturdy construction so fixed that the cutter imparts a rolling motion to the wheel grains. Leaves sharp corners and puts the wheel in best possible condition. Moderately priced.

Made in two sizes, 11-in. and 12½-in. long. Write for full particulars.

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Dominate markets through unquestioned superiority

DOMINATE your markets by improving your product to the point of unquestioned superiority. Manufacture mechanical equipment incorporating such time and labor saving features, that machinery users will realize ordinary equipment is a liability in comparison.

To the prospective designer of such equipment Cutler-Hammer Magnetic Clutches open a vast field of development.

These features of C-H Clutches enable you to design better machinery

Eliminate Clutch Trouble: No toggles, levers, or links to get out of order. Load pick-up is smooth and grabless.

Remote Control: A simple knife or button switch engages or disengages a C-H Clutch. The control switch may be placed where most convenient to the operator. This feature is in line with the tendency toward centralization of control on mechanical equipment.

Automatic Control: Limit switches and governor switches may be arranged to correlate automatically various members of a machine during a sequence of operations or automatically to engage and disengage clutches at desired r. p. m.

The possibilities of improved design through the use of C-H Magnetic Clutches are limitless. A consultation with C-H Clutch Engineers may aid you in improvements that will place your product in command of its markets.

The CUTLER-HAMMER Mfg. Co.

Pioneer Manufacturers of Electric Control Apparatus

1230 St. Paul Avenue
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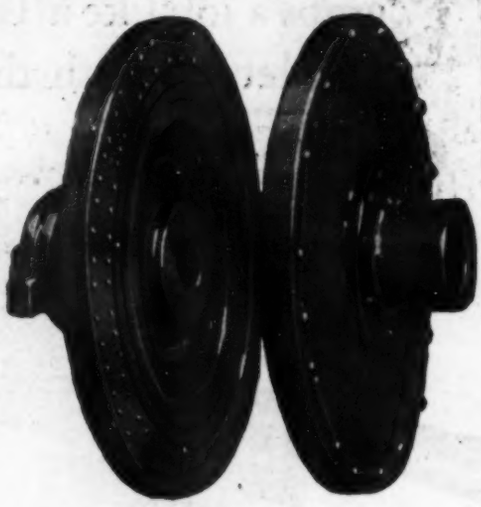

Sizes for every need

RATINGS OF CUTLER-HAMMER MAGNETIC CLUTCHES									
Diameter in Inches	7	10	12	14	16	20	24	28	32
Ultimate H.P. at 100 R.P.M.	.3	1.7	2.8	4.7	13.9	27	47	75	111
Maximum R.P.M.	3540	2840	2360	2040	1790	1420	1190	1050	900
Diameter in Inches	36	40	44	48	54	60	66	72	78
Ultimate H.P. at 100 R.P.M.	158	198	290	376	535	735	980	1270	2170
Maximum R.P.M.	800	710	650	600	550	480	425	395	365

To select the proper size C-H Clutch, add required safety factor to the peak horsepower required and divide by hundreds of revolutions per minute and consult table

Send for this booklet

Full details and engineering data together with examples of many practical installations of C-H Clutches are contained in this special booklet for machinery designers and production executives. A copy will be mailed on request

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Industrial Efficiency Depends on Electrical Control

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A.M.

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WANTED. Several first-class toolmakers to work on mold and die work in New England town of about 25,000. Ideal living conditions. Highest rates paid to steady and competent men. Positively do not want any floaters to answer this add. Apply to—American Insulator Corp., Danbury, Conn.

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EXPERIENCED designer for precision blanking and forming dies, good draftsman, capable if necessary, of handling die making. Satisfactory references, and co-operative personality required. Location Eastern Pennsylvania. P-321, American Machinist, 1600 Arch St., Phila., Pa.

TOOL-ROOM foreman wanted, familiar with dies and tools for stamping and punching operations. Must be able executive. Location Eastern Pennsylvania. Write, stating age, experience, salary expected. Send photo. P-297, American Machinist, 1600 Arch St., Phila., Pa.

EMPLOYMENT SERVICE

IF YOU are qualified for position between $2,500 and $25,000 and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established sixteen years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not an employment agency. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 266 Main Street, Buffalo, New York.

EXECUTIVES, engineers, find our individual, confidential Service effective in making new connections. Personally planned by Jacob Penn, the eminent employment authority, known to leading machinery manufacturers. Refund agreement protects you. Not agency. Jacob Penn, Incorporated, 305 Broadway, New York.

EMPLOYMENT AGENCY

AMERICAN Engineers Service, Emich Bldg., Pittsburgh. Require plant engineers, chief draftsmen, designers, detailers, salesmen with complete records attractive to employers. Rolling mills, tools, forgings, machinery, conveyors, engines, metal products.

WANTED
High class A-1 Tool Designer and Production Time Estimator by
Turret Lathe Manufacturer in Middle West.
One thoroughly experienced and capable taking complete charge of this department.
Salary in accordance with ability and with excellent future prospects.
P-320, American Machinist
7 So. Dearborn St., Chicago, Ill.

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WORKS manager. Twenty years' practical, technical and executive experience on large and medium machine tool work; iron, brass and steel foundries; plate and shape fabricating; power house and plant equipment control. Record of achievement in large organizations. Salary may be based on performance for right opening. PW-295, American Machinist, Tenth Ave. at 36th St., New York.

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FIRST-CLASS capable mechanic, with a wide range of executive ability on tool and productive links, such as manufacturing ball bearings, fire arms and building of light and heavy machinery and machine tools willing to take position as general foreman, superintendent or enter service or sales work. Location anywhere. References furnished if required. PW-323, American Machinist, Tenth Ave. at 36th Street, New York.

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METAL manufacturers, if you are in need of a good superintendent or manager, answer this ad. I am willing to take the position either on a salary basis or on part salary and commission on improvements and savings, which I will make. PW-316, American Machinist, 7 So. Dearborn St., Chicago, Ill.

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MANAGER or superintendent, practical and technical training, wide and varied experience. Good mechanic and executive with record of results. At present employed. PW-302, American Machinist, Star Bldg., St. Louis, Mo.

Maryland

FACTORY superintendent desires position. Can produce results, 33 years of age. Reference, wide experience. PW-307, American Machinist, 1600 Arch St., Phila., Pa.

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MASTER mechanic, superintendent or manager, American, 35, 20 years' practical and technical experience, original ideas, good organizer, eight years industrial engineering and supervision, would like to locate with a large concern requiring a man with ability. PW-306, American Machinist, 7 So. Dearborn St., Chicago, Ill.

New Jersey

MECHANICAL engineer over twenty years' experience, special machinery, design, manufacture, invention. Wide experience in drawing room and shop. Technical graduate. PW-322, American Machinist, Tenth Ave. at 36th St., New York.

POSITIONS WANTED

New York

DRAFTSMAN, 30, machine designer, plant maintenance, technical education, executive ability, moderate salary. Permanent or temporary. PW-313, American Machinist, Tenth Ave. at 36th St., New York.

TOOL room foreman, general foreman, master mechanic or superintendent, 43 years old; married. Practical machinist, tool and die maker, with technical training. 27 years, shop, engineering and executive experience. Specialist on all power press tools also on litho. and etched work. Desires to locate with company that recognizes ability, energy and efficiency. Location New York or commuting distance. PW-324, American Machinist, Tenth Ave. at 36th Street, New York.

Pennsylvania

FACTORY Manager: Capable mechanical engineer, master mechanic and executive of superior type; 28 years' experience in machine industry; highly skilled in design, development and production; expert in factory organization and management. 10 years chief engineer and works manager of prominent concern. Available on short notice. PW-308, American Machinist, 1600 Arch St., Phila., Pa.

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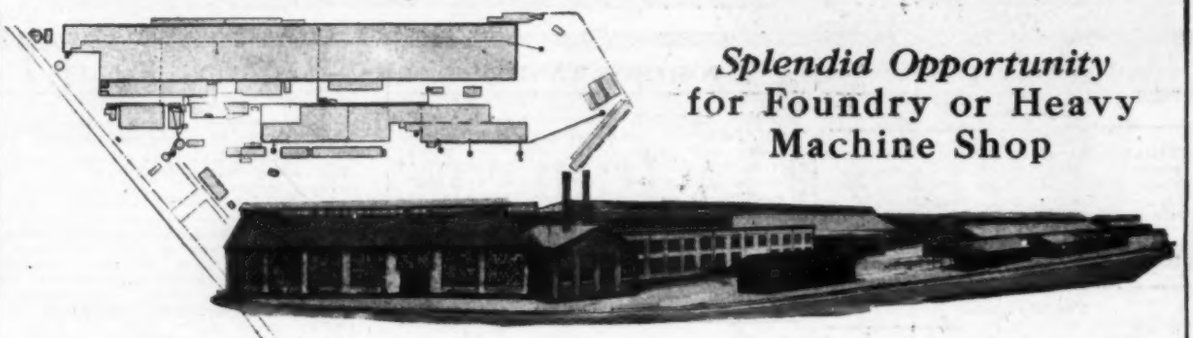

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1—33-51-in.x42-ft. Leblond.
1—33-51-in.x20-ft. Leblond.
1—15-in.x24-ft. Pond.
1—44-in.x16-ft. Putnam.
4—40-in.x12-ft. Fifield.
1—36-in.x12-ft. Gisholt Gun Boring.
2—36-in.x52-ft. Leblond, M.D.
3—36-in.x37-ft. N.-B.-P. M.D.
3—36-in.x30-ft. Pittsburgh, G.H.
1—36-in.x24-ft. Pittsburgh, G.H.
1—36-in.x20-ft. Pittsburgh, G.H.
3—36-in.x14-ft. Johnson Triple Gd.
1—36-in.x12-ft. Wickes.
1—32-in.x12-ft. Pittsburgh.
2—30-34-in.x12-ft. Lodge & Shipley selective Head.
3—30-in.x11-ft. H. S. & G.
2—27-in.x14-ft. Reed-Pren., G.H.
2—26-in.x18-ft. Bridgeford.
5—26-in.x16-ft. N.-B.-P.
2—26-in.x16-ft. Whit.-Blaisdell.
10—26-in.x16-ft. Bridgeford.
5—26-in.x14-ft. Bridgeford.
5—26-in.x14-ft. N.-B.-P.
2—26-in.x13-ft. Wickes.
3—26-in.x12-ft. Putnam.
5—26-in.x12-ft. Bridgeford.
13—26-in.x11-ft. Wickes.
30—26-in.x10-ft. N.-B.-P.
21—26-in.x10-ft. Canada.
15—26-in.x10-ft. Whit.-Blaisdell.
54—26-in.x10-ft. Bridgeford.
61—26-in.x 9-ft. Bridgeford.
16—26-in.x 8-ft. Bridgeford.
15—25-in.x12-ft. LeBlond.
5—25-in.x10-ft. LeBlond.
20—25-in.x10-ft. Sidney.
1—24-in.x12-ft. Reed-Pren., G.H.
9—24-in.x10-ft. Cisco.
1—24-in.x10-ft. American.
10—21-in.x10-ft. LeBlond.
5—10-22-in.x16-ft. American.
5—20-22-in.x12-ft. American.
3—20-22-in.x8ft. American. M.D.
30—20-22-in.x8-ft. American.
2—20-in.x8-ft. LeBlond.
3—19-in.x8-ft. LeBlond.
1—16-in.x8-ft. Monarch.
1—16-in.x8-ft. Walcott.
6—16-in.x6-ft. Walcott.
2—14-in.x8-ft. Carroll-Jamieson.
2—14-in.x6-ft. Carroll-Jamieson.
1—Bogart Crankshaft.
4—8-in. Fitchburg Loswing.
10—3½-in. Fitchburg Loswing.

Gear Cutters and Hobbers

3—No. 36 SM Gould & Eberhardt.
1—24-in.x12-ft. Gould & Eberahrdt.
2—No. 18-H Gould & Eberhardt.
1—No. 02 Fellows.
13—No. 6 Fellows.
1—No. 5 Lees-Bradner.
1—No. 1 Schuchardt & Schutte.
4—No. 1 Farwell.
1—No. 3—36-in. Brown & Sharpe.

Drill Presses

1—No. 30 Natco.
1—No. 41 Natco.
1—No. 17 4-spdl. Foote-Burt. Rail.
1—No. 6 3-spdl. Moline Hole Hog.
1—24-in. Colburn.
1—No. 24 Foote-Burt.
1—No. 310 Baker Comp. Table.
1—22-in. Barnes All Gd. Mfg.
11—No. 1-K 8-in. Henry & Wright.

Presses

1—06-G Toledo Double Crank.
2—No. DGG-56 Ferracute, Gd.
5—No. 58 Toledo Nosing.
1—No. 57 Toledo Nosing.
1—No. 163½ Toledo Toggle.

Profilers

2—Pratt & Whitney, Auto.
34—2-spdl. Newton.
8—No. 1, 2-spdl. Garvin.
14—2-spdl. Betts.

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Horizontal Boring Machines

TABLE TYPE

1—2-spdl. Espen-Lucas Boring, Milling and Drilling Machine.
1—No. 3 Beaman & Smith Engine Frame and Cylinder Borer.
1—Beaman & Smith Cylinder Boring and Milling Machine.
5—No. 1 Barrett.
5—Rockford.

FLOOR TYPE

1—No. 1½ Beaman & Smith.
1—No. 1½ Giddings & Lewis.

Grinders

1—24x96-in. Norton.
1—20x96-in. Landis.
1—18-30-in.x96-in. Norton.
1—18x96-in. Norton.
3—14x72-in. Norton.
2—14x50-in. Norton.
1—14-22-in.x50-in. Norton.
1—12x120-in. Landis.
2—12x36-in. Landis.
2—12x36-in. Modern.
4—12x36-in. Fitchburg.
1—10x96-in. Norton.
2—10x72-in. Landis.
3—10x72-in. Norton.
1—10x52-in. Landis.
1—10x36-in. Norton.
1—10x36-in. Landis.
6—6x32-in. Norton.
4—22-in. P. & W. Surf.
1—No. 2 Cincinnati Univ.
1—No. 2 Fraser Univ.
2—No. 70 Heald Internal.
1—No. 20 Bryant Internal.
1—No. 10-A Bryant Internal.
1—Modern Internal.
2—No. 16-24-in. Besly Ring Wheel.
1—3½x36-in. Norton Cam.
1—No. 6 18-in. Besly Ring Wheel.

Planers

1—72x56-in.x36-ft. Cincinnati, 2 Hds. (Side hds. can be added.)
1—60x48-in.x30-ft. Hamilton.
1—42x42-in.x22-ft. D. & H.
1—42x42x 9-ft. N.-B.-P.
3—36x36-in.x18-ft. Cincinnati.
1—36x36-in.x12ft. Woodward & Powell, 2 Hds.
1—36x30-in.x20-ft. Whit.-Blaisdell.
1—36x30-in.x18-ft. Whit.-Blaisdell.
1—36x36-in.x12-ft. Gray.
1—30x30-in.x14-ft. N.-B.-P.
1—30x30-in.x8-ft. N.-B.-P.
1—24x24-in.x6-ft. Rockford.
1—24x24-in.x6-ft. Hamilton.

Our guarantee is concise and unmistakable: Your money back if you return a machine within thirty days, freight prepaid. No excuses necessary.

Thread Millers

1—6x14-in. Pratt & Whitney.
7—No. 3-E. Lees-Bradner.
2—No. 3 Lees-Bradner.
1—Holden-Morgan.
3—HM Foster.

Slab Milling Machines

1—32x32-in.x12-ft. Ingersoll.
1—24x13-in.x20-ft. Ingersoll.
1—24x24-in.x8-ft. Ingersoll.
7—24x24-in.x12-ft. Ingersoll.
1—No. 3 92x54-in.x15-ft. Beaman & Smith Milling and Boring Machine, Planer Type.
1—Beaman & Smith Open Side.
1—3-spdl. Beaman & Smith.

Vertical Boring Mills

5—72-in. Gisholt.
1—72-in. Cincinnati.
1—42-in Colburn.
1—36-in. Bullard New Era.
1—30-in. Bullard.
1—24-in. Bullard Rapid Prod.

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5—No. 6-A Potter & Johnston.
4—No. 5-A Potter & Johnston.
1—No. 2-P Potter & Johnston.
1—No. 56 2¼-in. National Acme.
3—No. 75 1⅝-in. National Acme.
1—2-in. Model A Cleveland.
1—1½-in. Model A Cleveland.
1—⅞-1¼-in. Cleveland.
4—⅝-⅞-in. Cleveland, 2 Hds.

Radial Drills

2—3-ft. American Sentitive.

Hand Screw Machines

1—No. 10 3-in. Bardons & Oliver.
1—No. 5½ Bardons & Oliver.
3—No. 8 Warner & Swasey.
2—No. 6 2¼-in. Warner & Swasey.
1—No. 4¼ 1¾-in. Bardons & Oliver.
20—No. 3 1⅝-in. Foster.
1—No. 3 1¼-in. Bardons & Oliver.
9—No. 2 1⅛-in. Foster.
1—No. 2 1-in. Bardons & Oliver.
1—1x15-in. Pratt & Whitney.
1—No. 2⅝-in. Pratt & Whitney.

Turret Lathes

1—26-in. Libby.
9—25-in.x10-ft. LeBlond Univ.
26—24-in. Davis.
5—24-in. Steinle.
2—21-in. Gisholt.
26—21-in.x10-ft. LeBlond Univ.
3—20-in.x8-ft. American.
23—19-in.x8-ft. LeBlond.
24—19-in.x8-ft. LeBlond Univ.
2—2-spdl. Jones & Lamson.
1—15x7-in. Bardons & Oliver.
2—14-in. Foster.
1—1½-in. Pratt & Whitney.

Milling Machines

4—No. 4 Cincinnati.
2—No. 4 LeBlond.
3—No. 3-B Heavy B. & S.
1—No. 3 B. & S.
8—No. 3 Kempsmith.
1—No. 2 Kempsmith.
2—No. 2-B Heavy B. & S.
1—No. 1 Brown & Sharpe Univ.
1—No. 3 Garvin.
10—No. 1 Van Norman, Hand.
31—No. 0 Bristol.
3—Pratt & Whitney, Cam.
1—4-in. Pratt & Whitney Spline.
7—Putnam Semi Auto.
1—No. 33 Kempsmith.
175—P. & W. Hendey, Becker and Garvin Lincoln Millers.

Vertical Millers

2—Model ACS 2-spdl. Becker.
3—Model SD Becker.
1—No. 6 Becker.
2—No. 5-C Becker.
2—No. 5-B Becker.
1—Model CS Becker.
3—Model B Becker.
1—No. 3 Cincinnati Hi-Power.
6—No. 3 Brown & Sharpe.
1—No. 3-B Milwaukee.
1—Model AB Becker.
1—No. 2-B Milwaukee.
1—No. 4-B Becker.

Miscellaneous

1—24-in. Comb. Disc. and Sander.
18—Pilton Slotters.
1—No. 2-X Garvin 4-spindle Vertical Tapper.
1—No. D-125 Fairbanks Hammer.
1—20-24 Dill Slotter.
1—No. 3-B LaPointe.
3—No. 4 LaPointe.
1—No. 4 J. N. LaPointe.
1—2-spindle Hoefer Cylin. Borer.
1—No. 3 Beaudry Hammer.

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at which time we take this opportunity to extend our sincere appreciation to our many old and new friends, for the business they have given us.

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1—**N. B. P.** (Bement) 72-in. Duplex Horiz. Boring Mill; 4½-in. bar; air. m.d.
2—**Bullard** 24-in. N. E. Type.
1—**Bullard** 24-in. Rapid Prod. Type.
1—**Cleveland** No. 1 Horiz.
1—**Colburn** 54-in.; 2 swivel hds.
1—**Ridgeway** 84-in. Ver.; 2 hds.

DRILLS—Upright and Radial

6—**Leland & Gifford** 1 and 2 spdle; power feed.
1—**Colburn** No. 4.
1—**Colburn** No. 2.
1—**P&W** No. 1 Gun Barrel.
2—**New Turner** No. 3 vert.
6—**Baker** No. 310, and No. 314.
1—**Minster** No. 2-D heavy.
1—**Baush** 6-ft. Radial.
1—**Niles Bement Pond** 96-in. Ridgeway M.D. Pl. Rad.

DRILLS—Multiple Spindle

2—**Natco** No. 14, 16-in. rd. hd.
2—**Baush** No. 3 21-spindle
2—**Baush** No. 2 24-spindle.
1—**Moline** 4-spindle.
1—**Moline** No. 5-D 6-spindle.
1—**Foote-Burt** No. 17 6-spdle.
2—**Pratt & Whitney** No. 11, 1 round hd.
10—**Pratt & Whitney** Nos. 3, 12, 13.

AUTOMATIC SCREW MACHINES

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1—**B. & S.** No. 19.
14—**Gridley** 4-spindle ⅜, 1¼, 1¾, 7/16, 2⅝, 2¼-in.
2—**Gridley** 4¼, 3½-in. S. S.
8—**Cleveland** ⅝-½, ⅞, 1¼, 2, 2¼, 7¾-in. A.
6—**Cleveland** ⅝-⅞, ⅞, 1¼-in. B.
1—**New Britain** 1⅝x7 bar.
10—**New Britain** Nos.23, 24, 33.
2—**National ACME** Nos. 52, 54.

MILLING MACHINES

1—**Becker** No. 7 Duplex.
1—**Newton** Duplex.
1—**Milwaukee** No. 2-B Univ.
2—**Hendey** No. 1 Universal.
2—**Kearney & Trecker** No. 2 Univ.
2—**Cincinnati** No. 1½ Univ.
1—**Cincinnati** No. 2 Univ.
1—**Briggs** "B" Pl. Millers.
2—**Rockford** No. 1½; No. 2.
1—**Cincinnati** Nos. 2, 3 and 4 Plain, cone drive.
1—**Brown & Sharpe** No. 2, 2B, 3B, 4 Pl.
1—**B. & S.** No. 13-B Plain.
1—**Milwaukee** No. 1½B Vert.
2—**Taylor & Fenn** Vertical.
12—**Becker** Nos. 3H, 4B, AB, 5C, C Ver.
9—**P & W** 4½x12; 6x48; 6x80 Thread.
4—**Lees-Bradner** Nos. 4, 6. Thread.
25—**Pratt & Whitney** No. 5 Auto.
30—**Pratt & Whitney** No. 4 Spline.

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20—**Barber Colman** No. 3, 12.
4—**Hercules** 8-in.
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3—**G. & E.** No. 18-H.
2—**G. & E.** No. 36-ST, 3 and 4-spindle Gear Roughers.
1—**G. & E.** 34-in. Combined Spur and Bevel Gear Cutter.
20—**Fellows** Nos. 61, 6, 615.
20—**Gleason bevel**, 6, 11, 18-in.
1—**Gleason** 15-in. Spiral Rougher.

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1—**Blanchard** No. 10, m. d.
1—**Queen City** 14x72 Pl.
7—**Norton** 6x32, 10x36, 16x36.
1—**Springfield** 12x12x48 vert.
1—**Diamond** 84-in. Guide Bar Grinder.
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1—**Persons & Arter** Rot. Sur.
1—**Persons & Arter** 12-in. Surface.
4—**Cincinnati** No. 2, 12x36.
1—**Landis** 14x48 Crank.
1—**Landis** 18x68 Crank.
1—**Fitchburg** 12x54.
11—**Bryant** No. 20 Chucking.
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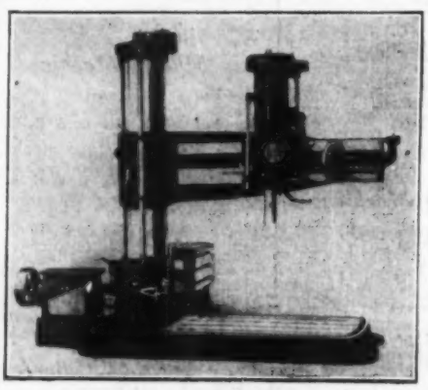

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20-in. **Prentice Wheel and Lever Drill**, 16-in. round table. $40
24-in. **Prentice Wheel and Lever Drill Press**, back geared, with tapping attachment; 18 in. round table. $125
36-in. **Prentice Sliding Head Upright Drill**, back geared; power feed. $175
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American Sensitive Radial Drill, three-step cone table 20x28 in. long; maximum distance column to spindle 25 in.; arm 29 in. long; 18 in. saddle travel on arm; belt drive to spindle; 3 in. adjustment of head. $140
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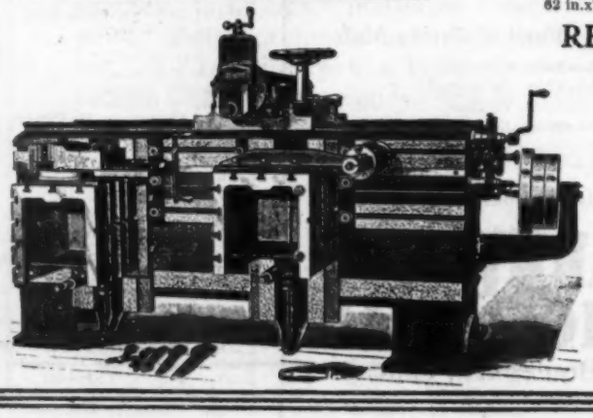

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No. 2-P Potter & Johnston Piston Machine.
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4-ft. Hammond Sensitive.
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LeBlond Universal Tool and Cutter.
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Nos. 3 and 12 Barber Colman Hobbers.
36-in. Cincinnati Spur.
26 and 36-in. Brown & Sharpe Spur.
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36-in.x16-ft. I. H. Johnson.

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24-in. Colburn.
24-in. Bullard.
36-in. Niles.
42-in. Bullard.
42-in. Detrick & Harvey.
53-in. Niles Bement Pond.

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2½-in. bar No. 2½ Universal.
2½-in. bar Cleveland.
3-in. bar Fosdick.
3-in. bar No. 3-A Universal.
3-in. bar No. 3 Lucas.
3-in. No. 5 Defiance.

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Nos. 2B, 2B8, and 3B Milwaukee plain.
No. 2B Heavy Brown & Sharpe plain.
No. 2½ Rockford plain.
No. 2½ LeBlond plain.
No. 3 Cincinnati plain.
Nos. 1 and 1½ Brown & Sharpe Univ.
Nos. 2 and 3 Kempsmith Universal.
No. 3 Ohio Universal.
No. 3 Knight Vertical.
No. 3-B Milwaukee vertical.
No. 4 Cincinnati vertical.

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No. 4 Walsh, 2½-in. stroke.
No. 3½ Stiles, 1-in. stroke.
No. 25 Cleveland, 2½-in. stroke.
No. 53 Toledo, 6-in. stroke.
No. DDG-54 Ferracute Double Action, Cam Drawing.
15, 30 and 50-ton Lucas Forcing.
150-ton Elmes Portable Hydraulic.
250-ton No. 18 Elmes Port. Hydraulic.

PIPE MACHINES
2-in. No. 1 Williams.
2-in. No. 1 Merrill Apex.
4-in. No. 2 Merrill Apex.
6-in. No. 3 Williams.
6-in. No. 216-B Oster.
6-in. Lovekin Pipe Expander.

PLANERS
28x28-in.x 6-ft. New Haven.
28x28-in.x 8-ft. Gray.
30x30-in.x 8-ft. Gray.
32x32-in.x 8-ft. Rockford.
32x32-in.x12-ft. Niles.
48x48-in.x10-ft. Cleveland Openside.
48x48-in.x10-ft. Niles Bement Pond.
18x48-in.x12-ft. Pond.

PUNCHES
36-in. tht. 1x1-in. Kling.
4-in. tht. No. 1 Hilles & Jones Horiz.
⅛x½ in. Double End.
12-in. tht., 1x1-in. Cleveland Horiz.
20-in. tht., 1¼x1-in. Rock River Double End.

ROLLS
6-ft.x¼-in. Wickes Drop End Bending.
No. 10 Pettingell for sheet metal.
50-in. Sheet Metal, hand power.

RIVETERS
Nos. 2-A and 3-A Hi Speed Hammers.
Nos. 30-A and 50-B Grant Spinners.
4-in. reach, 20-ton Hanna Pneumatic.
6-in. reach, 20-ton Allen Pneumatic.
10-in. reach, 20-ton Allen Pneumatic.
25-in. reach, 50-ton Allen Pneumatic.
72 in. reach, 50-ton Allen Pneumatic.

SAND BLASTS
60-in.x3-ft. Paxson tank.
Size 00, type LA Pangborn Rotary.
48-in. Hoevel Rotary.
36-in. No. 3 New Haven Tank.
Sand Riddle, air operated.
6x8x9-ft. Dust Arrester.

SLOTTERS
14-in. Niles.
24-in. Newton Crank.
2½-in. Pratt & Whitney.

SAWS
6x6-in. Racine High Speed Hack.
5x6-in. No. 7 Atkins Hack.
6x16-in. No. 5 Armstrong Blum Hack.
6-in. No. 160 Espen Lucas Cold.
No. 4-B Cochrane Bly Cold.
4-in. Higley Cold.

SHAPERS
14-in. Davis.
15-in. Stockbridge.
12-in. Niles.
24-in. Potter & Johnston.
24-in. Cincinnati.
30-in. Walcott.

SHEARS
⅜-in. Kling Rotary Plate Splitting.
⅜-in. Marshalltown Rotary Beveling.
8-ft.x18 ga. No. 196-F Niagara Squar'g
60-in. tht. Pettingell Rotary.
No. 10-P Marshalltown Rotary.
No. 18-H Marshalltown Rotary.

SCREW MACHINES
No. 2 Warner & Swasey.
No. 7 Bardons & Oliver.

TAPPERS
½-in. Acme 6 spdl. Semi-Auto. Nut.
½-in. Rickert Shafer Radial.
½-in. Rickert Shafer Vertical.
⅝-in. Rickert Shafer Horizontal.
No. 1 Garvin Vertical.
No. 2-H Garvin Horizontal.
No. 2 Garvin Vertical.
No. 2BG Garvin Vertical.

THREADERS
⅝-in. No. 2 and 1-in. No. 3 Adams.
1-in., 2-spdl. Reliance, Landis head.
1-in., 1½-in. and 4-in. Landis.
1-in. No. 2 National.
1¼-in. No. 2 National.
2-in., 2½-in. and 3-in. Acme.

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These are all steel body machines.
1-in., 1¼-in., 1½-in. and 2-in. Ajax.
2-in. Acme.

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Allen Arc. Transformer Type.
150-amp. Wilson.
300-amp. Wilson, 2 circuit.

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47-kva. 36-in. tht. Taylor.
125-amp. 42-in. reach Vollans.
50-amp. Vollans butt.
60-kva. type Winfield butt.

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MACHINERY COMPANY
SAGINAW, W. S.
MICHIGAN

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Each Machine Thoroughly Guaranteed!

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1—40-in.x32-ft. Pond Lathe, triple geared, face plate drive, compound rest, power cross feed, 2 steady rests, countershaft and regular equipment.
1—24-in.x10-ft. Hendey Lathe, tie bar head, quick change gear, complete regular equipment.
1—18-in.x6-ft. American Heavy Duty Lathe, quick change gear, double back gear, 3 step cone, latest type.
1—18-in.x8-ft. Lodge & Shipley Lathe, quick change gear, 3 step cone, double back gear.
2—13-in.x8-ft. Greaves & Klusman Lathes, semi quick change gear, 3 step cone, double back gear.
4—18-in.x8-ft. Reed-Prentice Lathes, taper attachment.
1—14-in.x6-ft. Hendey Lathe, tie bar head, quick change gear.

Planers and Shapers

1—30x30-in.x16-ft. Gray Planer, with 3 heads, spiral gear drive.
1—20x20-in.x5-ft. Whitcomb Planer, single head.
4—18x18-in.x4-ft. Whitcomb Planer, single head.
1—16-in. Cincinnati Back Geared Shaper.
1—16-in. American Shaper.
1—15-in. Potter & Johnston Shaper.
2—16-in. Whipp Back Geared Shapers. (Brand new).

Milling Machines

1—No. 2 S. B. Milwaukee Plain Miller, double over arm, nearly new.
1—No. 3 Cincinnati Plain Miller, single pulley drive.
1—No. 2 Cincinnati Plain Miller, cone drive.
1—No. 1 Brown & Sharpe Plain Miller, cone drive.
6—No. 1 Milwaukee Plain Miller, single pulley drive.
1—No. 2 Cincinnati Vertical Miller with Rotary Table.
1—Model B Becker Vertical Miller.
1—Model AB Becker Vertical Miller.
2—No. ½ Van Norman Duplex Milling Machines.

Presses

1—No. 169¾ S Toledo Toggle Drawing Press, tie rod construction. Area of bed 60x60 in., weight 250,000 lbs.
1—No. S.A. 953 Ferracute Double Action Toggle Drawing Press. Area of bed 54x112 in., weight 200,000 lbs.
1—No. S.S.A. 184 Ferracute Single Action Re-Drawing Press, triple geared. Area of bed 116x72 in., weight 165,000 lbs.
1—No. 5 Zeh & Hahneman Inclinable Power Press, stroke 2½ in., weight 2800 lbs.
5—No. 2 Pratt & Whitney Trimming Presses, with side shearing attachment.

Drilling Machines

1—5-ft. American Radial Drill, gear box drive, with tapping attachment, practically new.
3—3-ft. American High Speed Sensitive Radial Drills, with tapping attachment and elevating table.
6—No. 25 Foote-Burt Heavy Duty Drill Presses, 1 with compound table.
1—No. 2 Avey Two Spindle High Speed Drill Press.
3—Class K Henry & Wright, 3 Spindle Drill Presses, high speed.
2—Allen 2 Spindle High Speed Drill Presses.

Miscellaneous

1—No. 12 Lees-Bradner Thread Miller, Capacity 10x10? in.
1—No. 12 Brown & Sharpe Plain Grinder, Capacity 8x36 in., late type.
1—0x80-in. Pratt & Whitney Thread Miller.
1—No. 10 Brown & Sharpe Plain Grinder, Capacity 6x20 in.
1—No. 4 Brown & Sharpe Gear Cutter, Capacity 36 in. x 9—4 pitch.
1—No. 3H Brown & Sharpe Gear Cutter, Capacity 24 in. x 8—3 pitch.
1—No. 6 Fellows Gear Shaper, Capacity 36 in.
1—No. 6 Brown & Sharpe Wire Feed Screw Machine.
1—No. 4 Brown & Sharpe Wire Feed Screw Machine.
1—No. 0 Brown & Sharpe Wire Feed Screw Machine.

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1—60-in. Cincinnati Vert. Mill.
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1—72-in. Niles, Late Type Mill.
1—84-in. Niles Vert. Boring Mill.
1—No. 3 Barrett Horizontal Boring Mill.
4—No. 12 and 13 P & W Multiple.
3—12-in. Cin-Bickford Upright with motor.
1—No. 12 Pratt-Whitney Deep Hole Driller, 16 ft. bed.
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2—No. 14 Natco 22 spindles.
3—No. 3 Bausch 40 spindles.
2—Moline Cylinder Boring.
1—6-ft. American Radial.
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14—6x32 to 26x144-in. Norton Plain Cylindrical Grinders.
1—No. 22 B&S Ingernal Grinder.
2—00 Brown & Sharpe Automatics.
5—0 Brown & Sharpe Automatics.
10—2¼ to 4¼ Gridleys S. S.
7—18-in. Libby Turret Lathes.
1—No. 3-A Warner-Swasey.
9—22x26-in. P. & W. Turret Lathes.
1—18-in.x36-ft. Hahn-Larmon Lathe.
2—30-in.x12-ft. American Grd. Hd.
1—36-in.x60-ft. Bridgeford Boring.
2—36-in.x20-ft. American Heavy Pattern.
1—38-in.x18-ft. Niles Bement Pond Geared Head.
1—42-in.x14-ft. American Lathe.
1—42-in.x22-ft. American Heavy Duty.
1—44-in.x34-ft. Bement Engine Lathe.
2—48-in.x36-ft. Pittsburgh Gd. Hd.
1—60-in.x35-ft. Bement Engine Lathe.
1—50-in.x36-ft. Pittsburgh Gd. Hd.
1—72-in.x56-ft. N.B.P. Motor Drive.
1—72-in.x34-ft. Bement Engine Lathe.
9—5-in. P. & W. Automatic Millers.
1—No. 3-H Le Blond Plain Miller.
1—No. 3-H Hendey Plain Miller.
1—No. 3 Cincinnati H. P. Plain.
1—No. 5 Cincinnati H.P. Plain.
2—No. 4 Cincinnati H.P. Vertical.
1—No. 3 Cincinnati H.P. Vertical.
1—No. 2½ Rockford Universal.
1—No. 2½ Le Blond Universal.
1—No. 2½-H Milwaukee Vertical.
1—24x24x10 Ingersoll Slab.
1—36x36-in.x20-ft. Ingersoll Miller.
1—48x33-in.x20-ft. Ingersoll Miller.
1—60x60x26 D & H Openside Pl.
1—72x72x18 D & H Openside Pl.
1—96-in. Long-Allstatter Multiple Punch, Type C.
2—Hilles-Jones Guillotine Shears.
1—5x5 Alligator Shear.
1—No. 652 Niagara Squaring Shear.
1—28-in. Queen City Shaper.
1—24-in. Gould-Eberhardt Shaper.
2—28-in. Gould-Eberhardt Shapers.
1—16-in. American Shaper.
1—15-in. Potter-Johnston Univ. Shaper.
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1—No. 4-B Nazel Air Hammer.

1—1500-ton Mesta Hydraulic Press, 1500 lb. pressure, 42-in. ram, 40¼-in. piston, 4-ft. stroke, working surface between columns 5 ft. 4 in.

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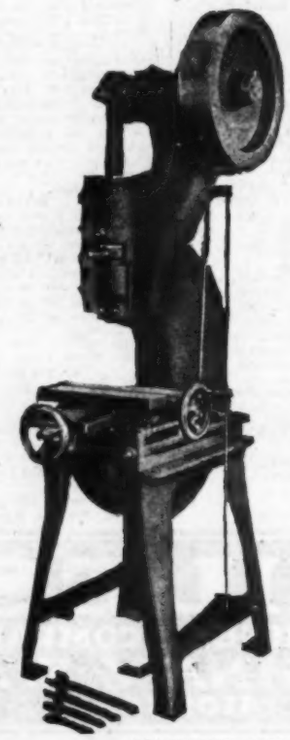

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(Like Cut)

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RANGE:—
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Table Top to End of Ram, Max.. 10-in.
Table Top to End of Ram, Min.. 3½-in.
Table Dimensions..... 8-in. x 16-in.
Table Longitudinal Travel, (2½-in. either way from center) 5-in.
Table Cross Travel, (2½-in. either way from center) 5-in.

FEEDS:—
Table Cross Power, .0015-in. to .0125-in.

SPEEDS:—
Ram Strokes 100 or 120 R. P. M. Generally used.
Floor Space..... 30-in. x 38-in.
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1—No. 3 Garvin Plain Milling Machine.
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1—18-in. Prentice Chucking Lathe.
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200-ton Hydraulic.
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No. 2 Norton Cutter.
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60 in. x 44 in. x 10 ft. Pond Planer.
72 in. x 54 in. x 20 ft. Pond Planer.
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16-in. and 24-in. Cincinnati Shaper.
20-in. Cincin'ti Travel'g Head Shaper.

MILLERS

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Nos. 1, 2 and 3 Brown & Sharpe Plain.
Nos. 1, 2 and 3 Hendey Universal.
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No. 13 B & S Automatic Gear Cutter, 18x4.
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No. 11 B & S Plain Grinder, 4x30.
No. 2 Morse Universal Grinder, 12x30.
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No. 3 Cincinnati Vertical Milling Machine.
No. 3 Cincinnati Plain Milling Machine.
No. 2½ Le Blond Universal Milling Machine.
24x6-ft. Ohio Planer.
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No. 2 Brown & Sharpe Universal Grinder.
No. 65 D-5 Moline Hole Hog Drill.
No. 216 Baker 4-spindle H.D. Drill.
24-spindle Fox Multiple Drill.
36x20 American H.D. Geared Head Engine Lathe.
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No. 24 Williams & White Bulldozer.

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4—22x12 Actual swing 24⅛-in. c.p.d. quick change gears, with taper attachments, like new.
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1—16x8 Greaves & Klusman, single pulley drive, arranged for motor drive.
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1—21-in. American back geared c.p.d.
1—16 Kelly c.p.d. back geared.

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1—No. 4 Cin. Plain, single pulley drive, very late model.
1—No. 3 LeBlond Plain, heavy duty, arranged for motor drive.
1—No. 3 SG Hendey, single pulley drive.
1—No. 3B Milwaukee double overhanging arm, arranged for motor drive.
1—No. 2 Cin. Plain, c.p.d. power feed up and down.
3—No. 2 Milwaukee Plain, c.p.d.
1—No. 3 Brown & Shaper Vertical with rotary table, late model.

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1—42-in. Bullard Boring Mill, with 2 heads on cross rail, with 10 HP., d.c. motor, push button control.
1—36-in. Bausch Boring Mill, 2 heads on cross rail, motor drive.
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1—4-ft. Cin. Bickford Radial Drill, like new.
1—6-ft. Prentice motor drive, with a.c. motor.

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2—No. 33 New Britain Automatic chucking machines.
2—2x24 Jones & Lamson flat turret lathes.
5—3x36 Jones & Lamson flat turret lathes.
2—3 spindle Jones & Lamson.
2—3¼-in. Gridley single spindle automatic.
3—5¾-in. Gridley single spindle, automatic.
1—48x48x14 Woodward & Powell Planer 4 heads on cross rail.
1—30x30x8 2 heads on cross rail.
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1—14x50 Norton cylindrical Grinder.
1—No. 14 Brown & Sharpe Cylindrical Grinder.
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1—Excelsior Tire Press 225 ton pressure.
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1—36-in. Cin. Bickford Sliding head drills, with tapping attachment.

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4x30-in. Pratt & Whitney, Plain Cylindrical Grinder.
No. 6 Gardner 26-in. Ball Bearing Disc Grinder.
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3-ft. Mueller Radial, Single Pulley Drive.
6-ft. Bickford Plain Radial, Gear Box.
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24-in. Aurora Sliding Head Drill Press.
24-in. Weigel Sliding Head Drill.
10-in. Betts Slotter, belt driven.
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No. 6 Becker-Brainard Horizontal Miller.
No. 4 Cincinnati Plain Miller, Cone Drive.
No. 3 Kempsmith Plain Miller, cone drive.
No. 3 Becker Vertical Miller.
No. 2½ LeBlond Heavy Duty Plain Miller.
No. 2 Kempsmith Plain Miller, cone drive.
No. 1 Cleveland Plain Miller, S.P.D.
No. 13 Garvin Plain Millers, cone drive (2).
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37-in. Bausch Vertical Boring Mill.
42-in. Bullard Vertical Boring Mill.
42-in. Bullard Rapid Production Vertical Boring Miller, turret head, motor driven.

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26-in.x14-ft. McCabe Screw Cutting Lathe.
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Imperial Brass Mfg. Co., Chicago.
Phosphor Bronze Smelting Co., Phila
Stewart Die Casting Corp., Chicago

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Sundstrand Mach. Tool Co., Rockford, Ill.

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Thomas Elec. Co., Chicago
Union Mfg. Co., New Britain
Wahlstrom Tool Co., Brooklyn
Westcott Chuck Co., Oneida
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Ney Co., J. M., Hartford
Skinner Chuck Co., New Britain
Thomas Elevator Co., Chicago
Union Mfg. Co., New Britain.
Westcott Chuck Co., Oneida
Whiton Mch. Co., D. E., New London

Chucks, Magnetic
Heald Machine Co., Worcester
Taft-Peirce Mfg. Co., Woonsocket
Walker Co., O. S., Worcester

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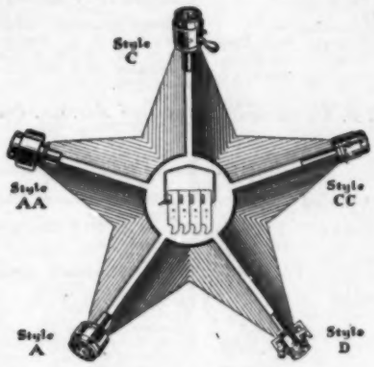

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Use this ONE set of Chasers

This means work and chasers may be shifted from one machine to another—from an automatic to a turret lathe or visa versa—without waiting for new chasers. This feature simplifies chaser stock and reduces the investment.

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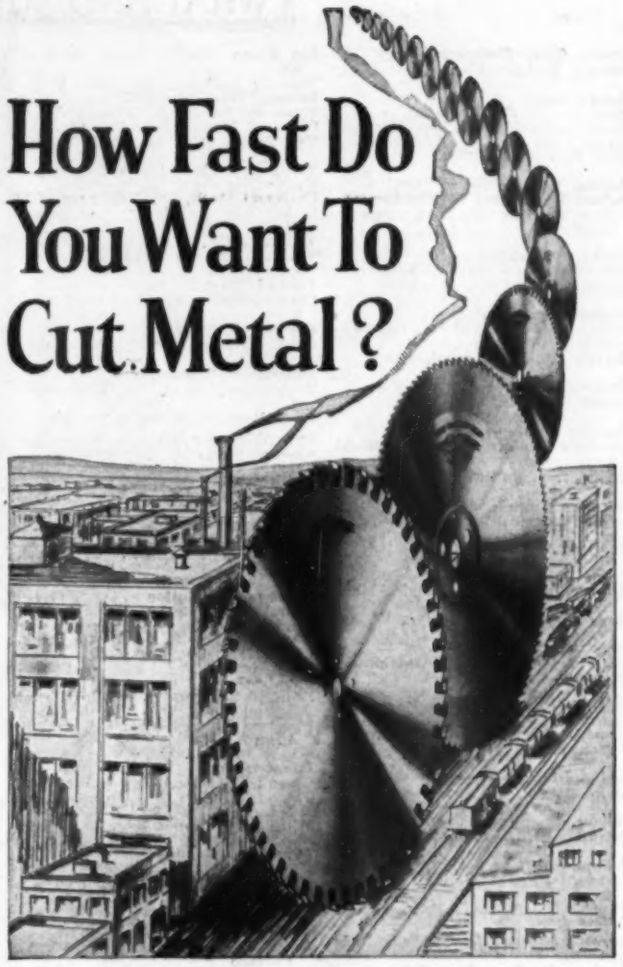

This is a problem yet in many shops where production lags. In other shops it has been solved by the use of Simonds Inserted Tooth and high grade Solid Metal Saws. Because of the wear-resisting steel, perfect mechanical construction and expert heat treating, Simonds Metal Saws give longer service and require less frequent grinding. Simonds Metal Saws—Solid or Inserted Tooth—are of Simonds special steel, made in Simonds Steel Mill.

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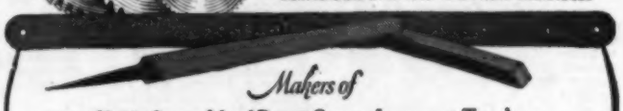

Makers of

Hack Saws, Metal Band Saws, Inserted Tooth Metal Saws, Solid Tooth Metal Saws, Slitting and Slotting Saws, Files, Tool Bits.

Chucks, Quick Change & Safety
National Tool Co., Cleveland

Chucks, Split
Ames Co., B. C., Waltham
Rivett Lathe Grinder Corp., Boston
Seneca Falls (N. Y.) Machine Co.
Stark Tool Co., Waltham

Chucks, Vertical Boring Mill
Bullard Mach. Tool Co., Bridgeport
Whiton Machine Co., D. E., New London

Chucks, Wrenchless
Thomas Elevator Co., Chicago
Wahlstrom Tool Co., Brooklyn

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Armstrong Bros. Tool Co., Chicago
Reed Mfg. Co., Erie
Starrett Co., L. S., Athol, Mass.

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Oakite Products, Inc., N. Y.

Cleaning Equipment, Metal
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Demco, Inc., Baltimore

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Cutler-Hammer Mfg. Co., Milwaukee

Clutches, Friction
Brown Co., A. & F., N. Y.
Brown Eng. Co., Reading
Johnson Mach. Co., Carlyle, Manchester, Conn.
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago
Moore & White Co., Philadelphia
Raybestos Co., Bridgeport

Coal and Ash Handling Machinery
Link-Belt Co., Chicago
Shepard Elect. Crane & Hoist Co., Montour Falls

Coal Storage Systems
Link-Belt Co., Chicago

Collars, Spacing
Detroit (Mich.) Stamping Co.

Collars, Shaft or Set
Standard Pressed Steel Co., Jenkintown

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Hardinge Brothers, Inc., Chicago
Ney Co., J. M., Hartford
Rivett Lathe & Grinder Corp., Boston
Union Twist Drill Co., Athol, Mass.
Wade Tool Co., Waltham
Whitney Mfg. Co., Hartford

Compounds, Carbonizing (See Case Hardening, etc.)

Compounds, Cleaning
Oakite Products, Inc., N. Y.

Compounds, Cutting, Drawing, Drilling, Grinding
Oakite Products, Inc., N. Y.

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Ingersoll-Rand Co., N. Y.
Sullivan Machinery Co., Chicago

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Barber-Colman Co., Rockford
Bethel Player Co., Westboro, Mass.
Boston (Mass.) Scale & Mach. Co.
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Phila.
Brown & Sharpe Mfg. Co., Providence
Columbus (O.) Die T. & M. Co.
Detroit (Mich.) Stamping Co.
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Fischer Mach. Co., Philadelphia
Fischer Spring Co., Brooklyn, N. Y.
Franklin Mach. Co., Providence
General Mach Wks., York
Gisholt Mch. Co., Madison, Wis.
Goldsmith Mfg. Co., Providence
Hart & Co., Inc., Frederick, Poughkeepsie, N. Y.
Hartford (Conn.) Special Mchy. Co.
Hoefer Mfg. Co., Freeport, Ill.
Jenekes Knit Mach. Co., Pawtucket
Keller Mech. Eng., Brooklyn.
Langelier Mfg. Co., Cranston, R. I.
Lambert & Todd Mach. Co., Camden
Liberty Tool & Gage Wks., Woonsocket, R. I.
Lincoln Mach. Co., Pawtucket.
Mehl Mach. Tool & Die Co., Roselle, N. J.
Meisel Press Mfg. Co., Boston.
Niles-Bement-Pond, N. Y.
Phoenix Tool & Mfg. Co., Bridgeport
Poorman, J. E., Phila.
Rowbottom Mach. Co., Waterbury
San Diego (Calif.) Lamp & Mfg. Co.
Simplex Tool Co., Woonsocket
Sprague Wks., New York
Sloan & Chase, Inc., Newark, N. J.
Standard Pressed Steel Co., Phila.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Toledo (O.) Machine & Tool Co.
Underwood Corp., H. B., Phila.
Universal Mach. Co., Baltimore.
Utility Tool & Mfg. Co., St. Louis, Mo.
Van Atta Co., E. B., Olean, N. Y.
Waltham (Mass.) Mach. Wks.

Control, Machine Tools
Cutler-Hammer Mfg. Co., Milwaukee

Controllers, Motor
Cutler-Hammer Mfg. Co., Milwaukee

Controllers, Temperature
Taylor Instrument Cos., Rochester

Controllers and Starters, Electric
Cutler-Hammer Mfg. Co., Milwaukee
General Elect. Co., Schnectady
Union Electric Mfg. Co., Milwaukee

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Cleveland (O.) Twist Drill Co.
National Tool Co., Cleveland
Pratt & Whitney Co., Hartford
Slocomb Co., J. T., Providence
Threadwell Tool Co., Greenfield, Mass.

Counters, Revolution
Bristol Co., Waterbury
Durant Mfg. Co., Milwaukee
Hart Mfg. Co., R. A., Battle Creek.
Veeder Mfg. Co., Hartford

Countershafts
Brown & Sharpe Mfg. Co., Providence
Diamond Mach. Co., Providence
Standard Pressed Steel Co., Jenkintown

Countersinks
Greenfield (Mass.) Tap & Die Corp.
Threadwell Tool Co., Greenfield, Mass.
Whitman & Barnes Mfg. Co., Akron

Couplings, Flexible
Brown Eng. Co., Reading
Boston Gear Works Sales Co., Quincy, Mass.
Foote Bros. Gear & Mach. Co., Chicago
Jones Fdry. & Machine Co., W. A., Chicago
Philadelphia (Pa.) Gear Wks.

Couplings, Shaft
Foote Bros. Gear & Mach. Co., Chicago
Johnson Mach. Co., Carlyle, Manchester, Conn.
Nicholson & Co., W. H., Wilkes-Barre
Standard Pressed Steel Co., Jenkintown

Cranes, Locomotive
Link-Belt Co., Chicago

Cranes, Traveling
Shephard Electric Crane & Hoist Co., Montour Falls, N. Y.
Niles Tool Works, N. Y.

Crank Pin Turning Machines
Underwood Corp., H. B., Phila.

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Brown & Sharpe Mfg. Co., Providence
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
O. K. Tool Co., Shelton, Conn.
Union Twist Drill Co., Athol, Mass.

Cutters, Keyseater
Davis Keyseater Co., Rochester

Cutters, Milling
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Butterfield & Co., Derby Line, Vt.
Geometric Tool Co., New Haven.
Ingersoll Milling Mch. Co., Rockford
National Twist D. & T. Co., Detroit
O. K. Tool Co., Shelton, Conn.
Pratt & Whitney Co., Hartford
Reed-Prentice Corp., Worcester
Sommers & Adams Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Whitney Mfg. Co., Hartford

Cutting-Off Machines
Armstrong-Blum Mfg. Co., Chicago.
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence
Etna Mch. Co., Toledo
Gorton Mach. Co., Geo., Racine
Greenfield (Mass.) Tap & Die Corp.
Landis Mach. Co., Waynesboro
Pratt & Whitney Co., Hartford

Cutting-Off Machines, Pipe (See Pipe-Cutting and Threading Machines)

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago

Dealers, Machinery (See Searchlight Section)
Associated Mach. Tool Co., Brooklyn
Botwinik Bros., New Haven Conn.
Brownell Mchy. Co., Providence
De Witt Tool Co., N. Y. C.
Eddy Machy. Co., E. A., Providence
Essley Mchy. Co., E. L., Chicago
Hill, Clarke & Co., Chicago
Hyman & Sons, Jos., Philadelphia
Lamberg & Co., A., N. Y.
Lucas & Son, Inc., J. L., Bridgeport, Conn.
Miles Mach. Co., Saginaw
Morey & Co., N. Y.
Nast Mach Co., Phila.
N. J. Mach. Exchange, Newark
Niles & Co., F. H., Jersey City
Osborne & Sexton Mchy. Co., Columbus
Prentiss & Co., Henry, N. Y.
Reed Prentic Corp., Worcester
Riverside Machy. Depot, Clevelad
Simmons Mach. Tool Corp., Albany
Wayne Mach. Co., Ft. Wayne
Wickes Mchy. Co., Jersey City, N. J.

Demagnetizers
Walker Co., O. S., Worcester

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Desmond-Stephan Mfg. Co., Urbana
Dickinson, Thomas L., N. Y.
Koebel Diamond Co., N. Y.
Wheel Trueing Tool Co., Detroit

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Danly Machine Specialties, Chicago
U. S. Tool Co., Ampere, N. J.

Die Makers Supplies
Danly Mach. Spec., Chicago

Die Making Machines
Haskins Co., R. G., Chicago
Keller Mech. Eng. Co., Brooklyn
Wheel Trueing Tool Co., Detroit
White Mfg. Co., S. S., N. Y.

Die Sets
Danly Mach. Specialties, Inc., Chicago

Die Holders for Presses
Bilton Mach. Tool Co., Bridgeport

Dies, Forging
Butterfield & Co., Derby Line, Vt.
Keller Mech. Eng. Co., Brooklyn

Dies, Self-Opening Adjustable
Cons. Mach. Tool Corp., Rochester
Eastern Mach. S. Corp., New Haven.
Geometric Tool Co., New Haven
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mach. Co., Waynesboro
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland

Dies, Sheet Metal and Sub-Press (See Contract Work)

Discs, Steel Marking
Noble & Westbrook Mfg. Co., Hartford

Dies, Threading-Opening
Eastern Mach. S. Corp., New Haven
Geometric Tool Co., New Haven
Greenfield (Mass.) Tap & Die Corp.
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mach. Co., Waynesboro
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Mchy. Co., Tiffin, Ohio

Dividing Heads
Knight Mchy. Co., W. B., St. Louis
U. S. Mch. Tool Co., Cincinnati

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago
J. H. Williams & Co., Buffalo

Dressers, Grinding Wheel
Bay State Stamping Co., Worcester.
Desmond-Stephan Mfg. Co., Urbana
Norton Co., Worcester

Drill Holders
Armstrong Bros. Tool Co., Chicago.

Drill Speeders
Graham Mfg. Co., Providence

Drilling Machine Heads
Hoefer Mfg. Co., Freeport
Langelier Mfg. Co., Cranston, R. I.
Rockford (Ill.) Drilling Machine Co.
U. S. Drill Head Co., Cincinnati

Drilling Machines, Automatic
Baker Bros., Toledo
Barnes Drill Co., Rockford, Ill.
Boeger-Meyer Mach. & Tool Co., Newark
Fox Mach. Co., Jackson, Mich.
Hoefer Mfg. Co., Freeport, Ill.
Kingsbury Mfg. Co., Keene, N. H.
Langelier Mfg. Co., Cranston, R. I.
Nat'l Automatic Tool Co., Richmond
Rockford (Ill.) Drilling Machine Co.

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Barnes Co., W. F. & John, Rockford
Cincinnati (O.) Electrical Tool Co.
Clark Electric Co., Jas., Jr., Louisville
Langelier Mfg. Co., Cranston, R. I.
Sloan & Chase, Inc., Newark, N. J.
Sundstrand Mach. Tool Co., Rockford, Ill.
Taylor & Fenn Co., Hartford

Drilling Machines, Electric and Pneumatic
Cincinnati (O.) Electrical Tool Co.
Ingersoll-Rand Co., N. Y.

Drilling Machines, Gang
Baker Bros., Toledo
Barnes Co., W. F. & John, Rockford
Barnes Drill Co., Rockford
Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Hoefer Mfg. Co., Freeport, Ill.
Langelier Mfg. Co., Cranston, R. I.
Rockford (Ill.) Drilling Mach. Co.
Taylor & Fenn Co., Hartford

Drilling Machines, Heavy Duty
Baker Bros., Toledo
Barnes Drill Co., Inc., Rockford
Cons. Mach. Tool Corp., Rochester
Foote-Burt Co., Cleveland
Hoefer Mfg. Co., Freeport, Ill.
Rockford (Ill.) Drilling Machine Co.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)

Drilling Machines, Multiple Spindle
Baker Bros., Toledo
Barnes Co., W. F. & John, Rockford
Barnes Drill Co., Rockford, Ill.
Boeger-Meyer Mach. & Tool Co., Newark
Cons. Mach. Tool Corp., Rochester
Foote-Burt Co., Cleveland
Fox Mach. Co., Jackson, Mich.
Grant Mfg. & Mach. Co., Bridgeport
Harrington Co., Philadelphia
Kingsbury Mfg. Co., Keene, N. H.
Langelier Mfg. Co., Cranston, R. I.
Moline (Ill.) Tool Co.
Nat'l Automatic Tool Co., Richmond
Niles Tool Works Co., N. Y.
Pratt & Whitney Co., Hartford
Rockford (Ill.) Drillig Mach. Co.
Sellers & Co., Wm., Philadelphia

Drilling Machines, Radial
American Tool Wks. Co., Cincinnati
Carlton Mach. Tool Co., Cincinnati
Cincinnati (O.) Bickford Tool Co.
Dreses Mch. T. Co., Cincinnati
Harrington Co., Philadelphia
Mueller Mach. Tool Co., Cincinnati
Niles Tool Works Co., N. Y.
Reed-Prentice Corp., Worcester
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia

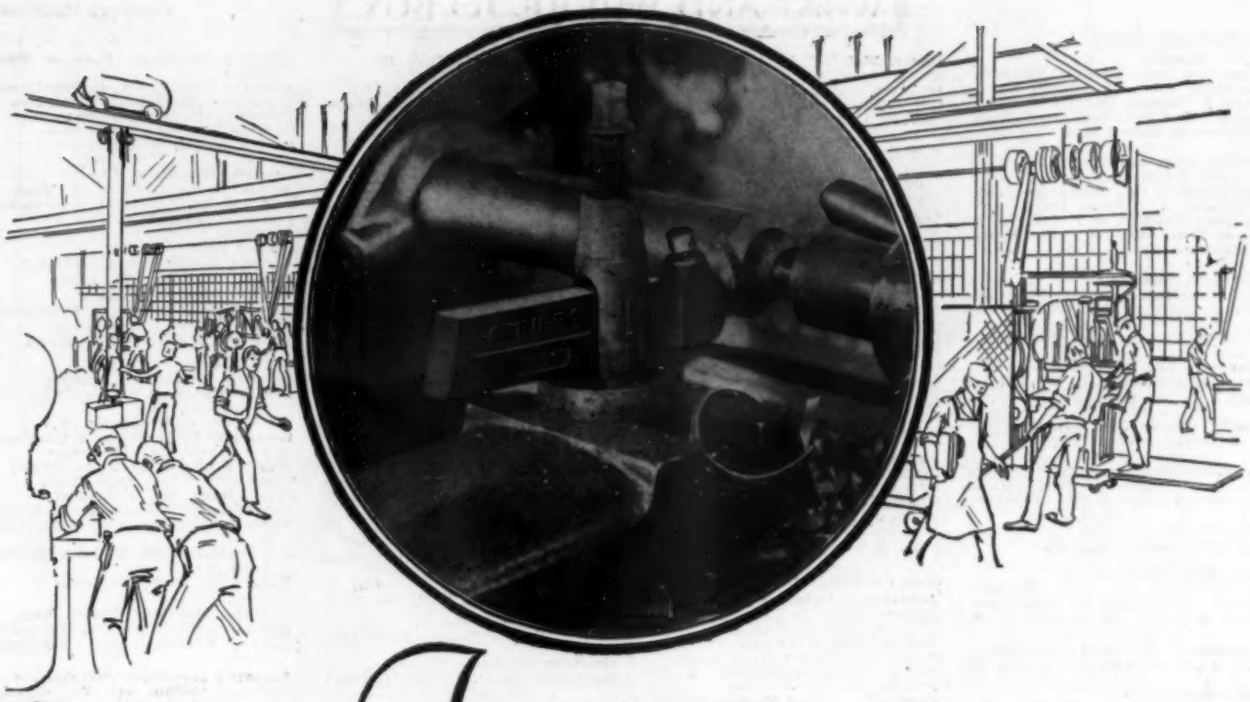
Drilling Machines, Sensitive
Ames Co., B. C., Waltham
Barnes Co., W. F. & John, Rockford
Carlton Mach. Tool Co., Cincinnati
Hardinge Brothers, Inc., Chicago
Kingsbury Mfg. Co., Keene, N. H.
Langelier Mfg. Co., Cranston, R. I.
Leland-Gifford Co., Worcester
Taylor & Fenn Co., Hartford
U. S. Mch. Tool Co., Cincinnati
Wisconsin Elec. Co., Racine

Drilling Machines, Turret
Hoefer Mfg. Co., Freeport, Ill.
Kingsbury Mfg. Co., Keene, N. H.
Nat'l Automatic Tool Co., Richmond

Drilling Machines, Vertical
Baker Bros., Toledo
Barnes Co., W. F. & John, Rockford
Barnes Drill Co., Inc., Rockford
Boeger-Meyer Mach. & Tool Co., Newark
Buffalo (N. Y.) Forge Co.
Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Harrington Co., Philadelphia
Henry & Wright Mfg. Co., Hartford
Kingsbury Mfg. Co., Keene, N. H.
Knight Mchy. Co., W. B., St. Louis
Langelier Mfg. Co., Cranston, R. I.
Leland-Gifford Co., Worcester
Ryerson & Son, Jos. T., Chicago
Taylor & Fenn Co., Hartford.
U. S. Mch. Tool Co., Cincinnati

Drills, Center
Cleveland (O.) Twist Drill Co.
Slocomb Co., J. T., Providence
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes Mfg. Co., Akron

Drills, Portable, Elec. and Pneumatic
Black & Decker Mfg. Co., Baltimore
Clark Electric Co., Jas., Jr., Louisville
Wisconsin Elec. Co., Racine



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"AGRIPPA" TOOL HOLDERS

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Whitman & Barnes Mfg. Co., Akron

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Buckeye Twist Drill Co., Alliance
Butterfield & Co., Derby Line, Vt.
Cleveland (O.) Twist Drill Co.
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes Mfg. Co., Akron

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Hart & Hegeman Mfg. Co., Hartford
Simplex Wire & Cable Co., Boston
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Link-Belt Co., Chicago

Emery Wheels (See Grinding Wheels)

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Hartford (Conn.) Special Mchy. Co.
Underwood Corp., H. B., Phila.

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Ingersoll-Rand Co., N. Y.

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Gorton Mach. Co., Geo., Racine.
Keller Mech. Eng. Co., Brooklyn
Preis & Co., H. P., Newark, N. J.

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Dixon Crucible Co., Jos., Jersey City

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Watson-Stillman Co., N. Y.

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American Swiss File & Tool Co., Elizabeth, N. J.
Simonds Sons & Steel Co., Fitchburg

Filing Machines
Ames Co., B. C., Waltham
Haskins Co., R. G., Chicago
Oliver Instrument Co., Adrian
White Mfg. Co., S. S., N. Y.

Filler, Iron (See Cements, Iron)

Fittings, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

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Grant Mfg. & Mach. Co., Bridgeport

Forging Machinery
Acme Mchy. Co., Cleveland
National Mchy. Co., Tiffin

Forgings, Drop
Bearings Co. of America, Lancaster, Pa.
Williams & Co., J. H., Buffalo

Fountains, Drinking
Manufacturing Equipt. & Eng. Co., Framingham, Mass.

Furnaces, Forging
American Gas Furnace Co., Elizabeth

Furnaces, Heat Treating
Hoskins Mfg. Co., Detroit

Furnaces, Heat Treating, Oil and Gas
American Gas Furnace Co., Elizabeth
Brown & Sharpe Mfg. Co., Providence
Johnson Gas Appliance Co., Cedar Rapids, Iowa
Strong, Carlisle & Hammond Co., Cleveland

Furnaces, Tempering and Annealing
American Gas Furnace Co., Elizabeth
Brown & Sharpe Mfg. Co., Providence
Johnson Gas Appliance Co., Cedar Rapids, Iowa
Strong Carlisle & Hammond Co., Cleveland

Furniture, Machine Shop
Armstrong Bros. Tool Co., Chicago
Brown Eng. Co., Reading
Manufacturing Equipt. & Eng. Co., Framingham, Mass.
New Britain (Conn.) Machine Co.

Gage Blocks
Pratt & Whitney Co., Hartford

Gages, Comparator
Federal Products Corp., Providence
Jones & Lamson Mch. Co., Springfield, Vt.

Gages, Dial
Ames Co., B. C., Waltham
Brown & Sharpe Mfg. Co., Providence
Federal Products Corp., Providence
Starrett Co., L. S., Athol, Mass.

Gages, Plug and Ring
Brown & Sharpe Mfg. Co., Providence
Hanson-Whitney Mach. Co., Hartford
Pratt & Whitney Co., Hartford

Gages, Recording
Bristol Co., Waterbury
Taylor Instrument Cos., Rochester

Gages, Snap, Thread and Cylindrical
Brown & Sharpe Mfg. Co., Providence
Federal Prod. Corp., Providence
Greenfield (Mass.) Tap & Die Corp.
Hanson-Whitney Mach. Co., Hartford
Pratt & Whitney Co., Hartford
Taft-Peirce Mfg. Co., Woonsocket, R. I.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence
Federal Products Corp., Providence
Greenfield (Mass.) Tap & Die Corp.
Hanson-Whitney Mach. Co., Hartford
Hartford (Conn.) Special Mchy. Co.
Pratt & Whitney Co., Hartford

Gear Cutting Machinery
Adams Co., Dubuque, Iowa
Barber-Colman Co., Rockford
Bilgram Machine Works, Phila.
Brown & Sharpe Mfg. Co., Providence
Cincin. (O.) Gear Cutting Mach. Co.
Fellows Gear Shaper Co., Springfield, Vt.
Flather Co. (The) Nashua, N. H.
Gleason Works, Rochester
Harrington Co., Philadelphia
Newark (N. J.) Gear Cut Mch. Co.
Sloan & Chase, Inc., Newark, N. J.
Wade Tool Co., Waltham
Waltham (Mass.) Mach. Wks.
Whiton Mch. Co., D. E., New London

Gear Tempering Machinery
Gleason Works, Rochester

Gear Testing Machinery
Adams Co., Dubuque, Iowa
Brown & Sharpe Mfg. Co., Providence
Gleason Works, Rochester
Newark (N. J.) Gear Cut. Mch. Co.
Scherr, George, New York

Gears, Cast
Brown & Sharpe Mfg. Co., Providence
Brown Co., A. & F., N. Y.
Caldwell & Son Co., H. W., Chicago
Cleveland (O.) Worm Gear Co.
Grant Gear Works, Boston
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago
Pennsylvania Gear & Machine Co., Phila.
Philadelphia (Pa.) Gear Works

Gears, Cut
Adams Co., Dubuque, Iowa
Albaugh-Dover Mfg. Co., Chicago
Bilgram Machine Works, Phila.
Boston Gear Works Sales Co., Quincy, Mass.
Brown & Sharpe Mfg. Co., Providence
Brown Co., A. & F., N. Y.
Cincinnati (O.) Gear Co.
Cleveland (O.) Worm Gear Co.
Diefendorf Gear Corp., Syracuse
Earle Gear & Mch. Co., Philadelphia
Fawcus Machine Co., Pittsburgh.
Fellows Gear Shaper Co., Springfield, Vt.
Flather Co. (The), Nashua, N. H.
Foote Bros. Gear & Mach. Co. Chicago
Franklin Die Casting Corp., Syracuse
Ganschow Co., Wm., Chicago
Gleason Works, Rochester
Grant Gear Works, Boston
Horsburgh & Scott Co., Cleveland
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago
Meisel Press Mfg. Co., Boston
Newark (N. J.) Gear Cutting Mch. Co.
Niles Tool Works Co., N. Y.
Nuttall Co., R. D., Pittsburgh
Pennsylvania Gear & Machine Co., Phila.
Philadelphia (Pa.) Gear Works
Simonds Mfg. Co., Pittsburgh

Gears, Forged
Bethlehem (Pa.) Steel Co.
Grant Gear Works, Inc., Boston
Philadelphia (Pa.) Gear Wks.

Gears, Speed Reducer
Albaugh-Dover Mfg. Co., Chicago
Boston Gear Works Sales Co., Quincy, Mass.
Cleveland (Ohio) Worm & Gear Co.
Earle Gear & Mach. Co., Phila.
Foote Bros. Gear & Mach. Co., Chicago
Grant Gear Works, Inc., Boston
Horsburgh & Scott Co., Cleveland
Niles Tool Works Co., N. Y.
Philadelphia (Pa.) Gear Works

Generators, Electric
Reliance Elect. & Eng. Co., Cleveland

Grease Cups
Greas-om-eter Corp., San Francisco

Grinding Machines, Auto. Head & End
Arter Grinding Mach. Co., Worcester.

Grinding Machines, Ball Bearing Race (See Grinding Machines, Radial)

Grinding Machines, Bench
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Elec. Tool Co.
Clark Electric Co., Jas., Jr., Louisville
Diamond Mach. Co., Providence
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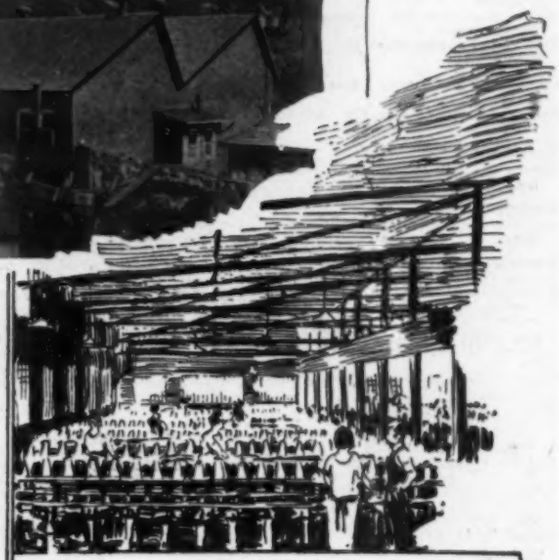

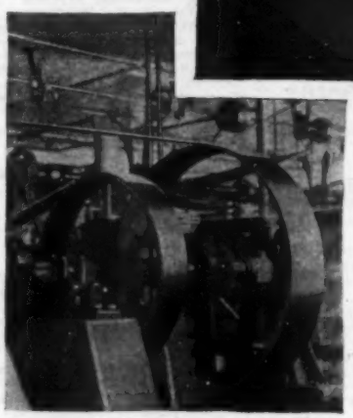

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Pumps, Power
Ingersoll-Rand Co., (A. S. Cameron Steam Pump Works), N. Y.
Sullivan Mchy. Co., Chicago

Pumps, Steam
Ingersoll-Rand Co., (A. S. Cameron Steam Pump Works), N. Y.

Pumps, Vacuum
Ingersoll-Rand Co., (A. S. Cameron Steam Pump Works), N. Y.

Punch Press Accessories
Danly Mch. Spec., Chicago

Punches and Dies
Pratt & Whitney Co., Hartford

Punches, Center
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Armstrong-Blum Mfg. Co., Chicago

Punches, Power
Bowser & Co., S. F., Ft. Wayne, Ind.
Buffalo (N. Y.) Forge Co.
Mitts & Merrill, Saginaw
Niagara Mach. & Tool Wks., Buffalo
Ryerson & Sons, Joseph T., Chicago
Watson-Stillman Co., N. Y.

Punching and Shearing Machines
Cons. Mach. Tool Corp., Rochester
Wickes Bros., Saginaw, Mich.

Pyrometers, Electric
Bristol Co., Waterbury.
Taylor Instrument Cos., Rochester

Rack Cutting Machines
Newark (N. J.) Gear Cutting Mch. Co.

Racks, Cut
Boston Gear Works Sales Co., Quincy, Mass.
Grant Gear Works, Inc., Boston
Meisel Press Mfg. Co., Boston
Foote Bros. Gear & Mach. Co., Chicago

Racks, Storage (See Furniture, Machine Shop)

Rammers, Foundry
Brown & Sharpe Mfg. Co., Providence
Reamer Holders
Landis Machine Co., Waynesboro
McCrosky Tool Corp., Meadville, Pa.
Nicholson & Co., W. H., Wilkes-Barre

Reamers, Adjustable
Brubaker & Bros. Co., W. L., N. Y.
Cleveland (O.) Twist Drill Co.
Gammons-Holman Co., Manchester
Gisholt Mch. Co., Madison, Wis.
Greenfield (Mass.) Tap & Die Corp.
McCrosky Tool Corp., Meadville
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford
Taft-Peirce Mfg. Co., Woonsocket
Whitman & Barnes Mfg. Co., Akron

Reamers, Solid
Brubaker & Bros. Co., W. L., N. Y.
Buckeye Twist Drill Co., Alliance
Butterfield & Co., Derby Line, Vt.
Cleveland (O.) Twist Drill Co.
Gammons-Holman Co., Manchester, Conn.
Greenfield (Mass.) Tap & Die Corp.
Hjorth Lathe & Tool Co., Boston
National Tool Co., Cleveland
Pratt & Whitney Co., Hartford
Reed Mfg. Co., Erie
Threadwell Tool Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes Mfg. Co., Akron

Reamers, Taper
Brown & Sharpe Mfg. Co., Providence
Gammons-Holman Co., Manchester, Conn.
Greenfield (Mass.) Tap & Die Corp.
Pratt & Whitney Co., Hartford
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes Mfg. Co., Akron

Recorders, Pressure
Bristol Co., Waterbury
Taylor Instrument Cos., Rochester

Recorders, Temperature
Bristol Co., Waterbury
Taylor Instrument Cos., Rochester

Regulators, Temperature
Taylor Instrument Cos., Rochester

Rheostats
Cutler-Hammer Mfg. Co., Milwaukee

Rivet Making Machinery
National Machinery Co., Tiffin

Rivet Sets
Hunter Saw & Mch. Co., Pittsburgh

Riveting Machines
Grant Mfg. & Machine Co., Bridgeport
National Equipment Co., Springfield, Mass.
Ryerson & Son, Jos. T., Chicago

Rod Cutters
Tucker, W. A. & C. F., Hartford

Rules, Steel & Wood
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.

Rust Preventatives
Oakite Products, Inc., N. Y.

Sand Rammers, Pneumatic
Ingersoll-Rand Co., N. Y.

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Amer. Saw & Mfg Co., Springfield, Mass.
Simonds Saw & Steel Co., Fitchburg
Starrett Co., L. S., Athol, Mass.
Thompson & Son Co., Henry G., New Haven

Saw Sharpening Machines
Hunter Saw & Mch. Co., Pittsburgh
Simonds Saw & Steel Co., Fitchburg

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Armstrong-Blum Mfg. Co., Chicago.
Earle Gear & Machine Co., Phila.
Greenfield (Mass.) Tap & Die Corp.
Peerless Machine Co., Racine
Stockbridge Mach. Co., Worcester

Sawing Machines, Power Hack
Armstrong-Blum Mfg. Co., Chicago.
Peerless Machine Co., Racine
Stockbridge Mach. Co., Worcester
Thompson & Son Co., Henry G., New Haven

Saws, Band
Simonds Saw & Steel Co., Fitchburg
Thompson & Son Co., Henry G., New Haven

Saws, Circular Wood
Simonds Saw Steel Co., Fitchburg

Saws, Coping
Simonds Saw Steel Co., Fitchburg

Saws, Cross Cut
Simonds Saw & Steel Co., Fitchburg

Saws, Hand
Simonds Saw & Steel Co., Fitchburg

Saws, High Speed
Ryerson & Son, Jos. T., Chicago

Saws, Inserted Tooth
Simonds Saw Steel Co., Fitchburg

Saws, Metal Cutting
Amer. Saw & Mfg. Co., Springfield, Mass.
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Union Twist Drill Co., Athol, Mass

Saws, Milling
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Simonds Saw Steel Co., Fitchburg
Union Twist Drill Co., Athol, Mass.

Saws, Screw Slotting
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Simonds Saw & Steel Co., Fitchburg
Starrett Co., L. S., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

Scales
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.

Scraping Machines, Metal
Anderson Bros. Mfg. Co., Rockford

Screw-Machine Work
Eastern Mch. Screw Corp., New Haven
Liberty Tool & Gage Wks., Woonsocket, R. I.
Link-Belt Co., Chicago
National Acme Co., Cleveland
New Britain (Conn.) Machine Co.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence
Cone Auto. Mch. Co., Windsor, Vt.
National Acme Co., Cleveland
New Britain (Conn.) Machine Co.
Standard Pressed Steel Co., Jenkintown

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Acme Machine Tool Co., Cincinnati
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Dreses Mch. Tool Co., Cincinnati
Gisholt Machine Co., Madison, Wis.
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Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford

Screw Plates
Brubaker & Bros. Co., W. L., N. Y.
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, O.
Carpenter Tap & Die Co., J. M., Pawtucket
Greenfield (Mass.) Tap & Die Corp.
Pratt & Whitney Co., Hartford
Threadwell Tool Co., Greenfield, Mass.

Screws, Cap and Set
Allen Mfg. Co., Hartford
Bristol Co., Waterbury.
Eastern Mch. Screw Corp., New Haven
National Acme Co., Cleveland
Standard Pressed Steel Co., Jenkintown
Strong, Carlisle & Hammond Co., Cleveland

Screws, Machine
Allen Mfg. Co., Hartford
Bristol Co., Waterbury
Eastern Mch. Screw Corp., New Haven

Screws, Safety Set (See Screws, Cap and Set)

Seamless Steel Tubing (See Tubing, Seamless Steel)

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Associated Mach. Tool Co., Brooklyn
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Duff Mchy. Corp., Columbia
Eddy Machy. Co., E. A., Providence
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Lamberg & Co., A., N. Y.
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Osborne & Sexton Mchy. Co., Columbus
Prentiss & Co., Henry, N. Y.
Reed Prentice Corp., Worcester
Riverside Machy. Depot, Kalamazoo, Mich.
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Wayne Machy. Co., Ft. Wayne
Wickes Mchy. Co., Jersey City, N. J.

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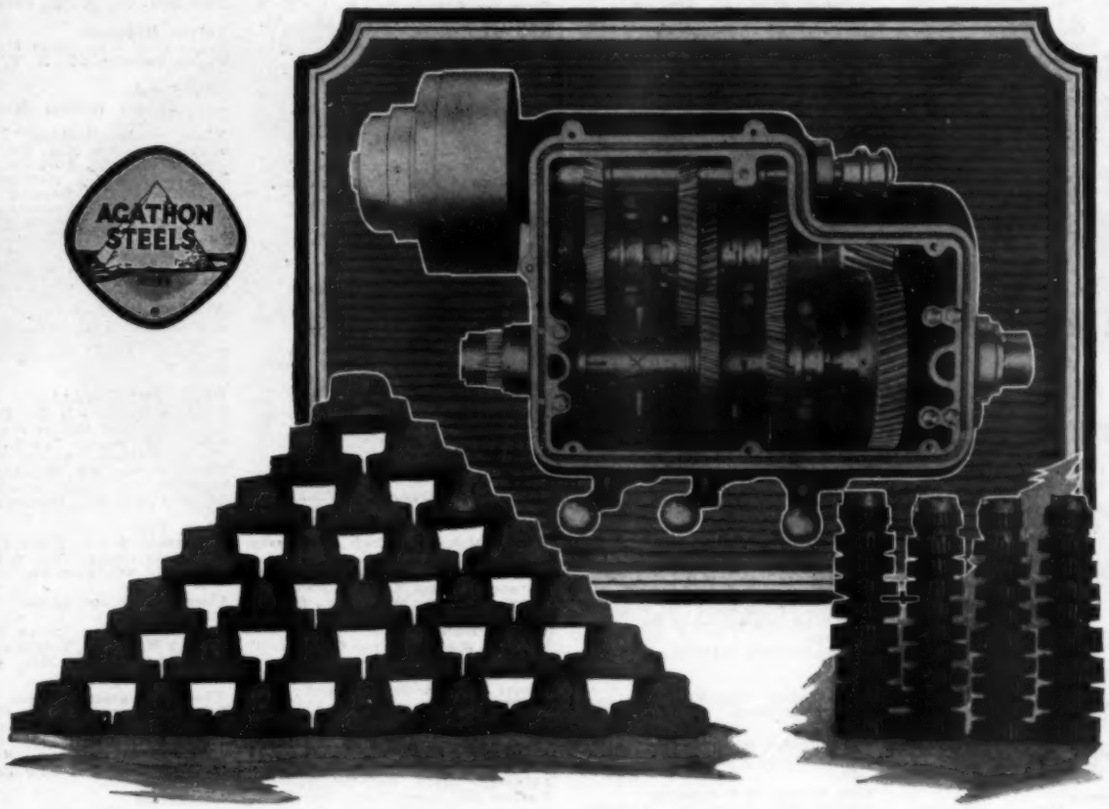

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Rockwood Sprinkler Co., Worcester

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Jessop & Sons, Wm., N. Y.
Ryerson & Son, Jos. T., Chicago
Simonds Saw & Steel Co., Fitchburg

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Bethlehem (Pa.) Steel Co.
Carpenter Steel Co., Reading
Central Alloy Steel Corp., Massillon, O.
Cleveland (O.) Twist Drill Co.
Columbia Tool Steel Co., Chicago Heights
Firth-Sterling Steel Co., McKeesport, Pa.
Hawkridge Bros. Co., Boston
Jessop & Sons, Wm., N. Y.
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Torrington Co., Torrington, Conn.

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Langelier Mfg. Co., Cranston, R. I.
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Sloan & Chase, Inc., Newark, N. J.
Wahlstrom Tool Co., Brooklyn
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Brubaker & Bros Co., W. L., N. Y.
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield
Carpenter Tap & Die Co., J. M., Pawtucket
Greenfield (Mass.) Tap & Die Corp.
Hanson-Whitney Mach. Co., Hartford
Landis Machine Co., Waynesboro
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Tool Co., Cleveland
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Taps, Collapsing
Cons. Mach. Tool Corp., Rochester
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Landis Machine Co., Waynesboro
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland

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Testing Apparatus, Hardness
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Bristol Co., Waterbury
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Geometric Tool Co., New Haven
Greenfield (Mass.) Tap & Die Corp.
Hanson-Whitney Mach. Co., Hartford
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
Pratt & Whitney Co., Hartford
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Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Grant Mfg. & Mach. Co., Bridgeport
Greenfield (Mass.) Tap & Die Corp.
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National Machinery Co., Tiffin

Thread Rolling Machines
National Machinery Co., Tiffin

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Firth-Sterling Steel Co., McKeesport, Pa.
Simonds Saw & Steel Co., Fitchburg

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Waterston, J. M., Detroit

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O. K. Tool Co., Shelton, Conn.
Williams & Co., J. H., Buffalo

Tool Posts, Lathe
Armstrong Bros. Tool Co., Chicago
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Tool Work (See Contract Work)
Tools, Small (See Machinists' Small Tools)

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Elwell-Parker Elec. Co., Cleveland

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Moore & White Co., Philadelphia
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Standard Pressed Steel Co., Jenkintown
Whitney Mfg. Co., Hartford

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Nuttall Co., R. D., Pittsburgh
Shepard Elect. Crane & Hoist Co., Montour Falls

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Turrets, Tool Post
American Tool Wks. Co., Cincinnati
McCrosky Tool Corp., Meadville, Pa.

Unions, Pipe
Dart Mfg. Co., E. M., Providence

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Armstrong Bros. Tool Co., Chicago
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Brown Eng. Co., Reading
Graham Mfg. Co., Providence
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Purvis & Son, Ed., Brooklyn
Thomas Elevator Co., Chicago

Vises, Metal Workers'
Fulton Drop Forge Co., Canal Fulton, Ohio
Hartford (Conn.) Special Mchy. Co.
Reed Mfg. Co., Erie

Vises, Milling Machine
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Greenfield (Mass.) Tap & Die Corp.
Hartford (Conn.) Special Mchy. Co.
Purvis & Son, Ed., Brooklyn
Reed-Prentice Corp., Worcester
Whitney Mfg. Co., Hartford

Vises, Pipe
Butterfield & Co., Derby Line, Vt.
Greenfield (Mass.) Tap & Die Corp.
Reed Mfg. Co., Erie, Pa.

Vises, Planer and Shaper
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Hartford (Conn.) Special Mchy. Co.
Hendey Mach. Co., Torrington, Conn.
Hoggson & Pettis Mfg. Co., New Haven

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Hartford (Conn.) Special Mchy. Co.
Hoggson & Pettis Mfg. Co., New Haven
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Lincoln Electric Co., Cleveland
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Imperial Brass Mfg. Co., Chicago
Weldit Acetylene Co., Detroit

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Taylor Welder Co., Warren
Lincoln Elect. Co., Cleveland
Weldit Acetylene Co., Detroit

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Hawkridge Bros. Co., Boston
Phosphor Bronze Smelting Co., Phila.

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Simplex Wire & Cable Co., Boston

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Whitney Mfg. Co., Hartford

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Seneca Falls (N. Y.) Machine Co.

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Albaugh-Dover Mfg. Co., Chicago
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Wrenches, Ratchet
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Wrenches, Tap
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Starrett Co., L. S., Athol, Mass
Threadwell Tool Co., Greenfield, Mass.

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